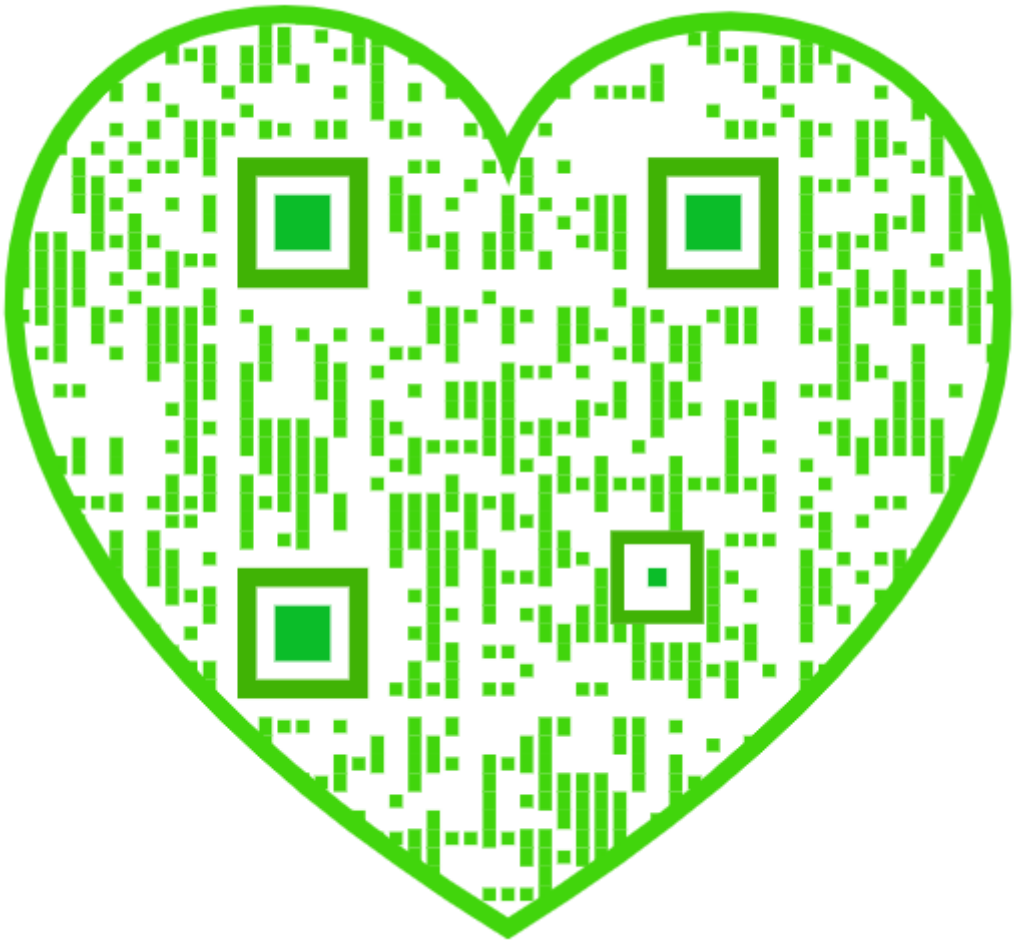

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REFERENCES.

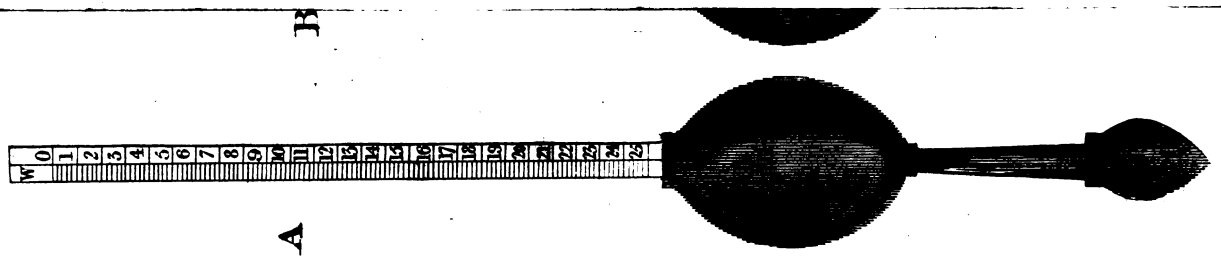
A. *The* SACCHAROMETER *showing the Strength of worts up to 25 lbs of Gravity P.r Barrel, without the weight.*

B. *The reverse side of D.e showing the strength from 25 to 52 lbs P.r Barrel, with the weight.*

C. *The Weight.*

D. *The* THERMOMETER *which acts in unison with the Saccharometer, obviating Rules and Tables.*

E. *The* SACCHAROMETER *and* THERMOMETER *in the assay Jar, as used in determining the qualities of worts.*



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A

PRACTICAL TREATISE

ON

BREWING,

AND ON

STORING OF BEER;

DEDUCED FROM

FORTY YEARS' EXPERIENCE.

By WILLIAM BLACK.

LONDON:
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PREFACE.

In no treatise on brewing which I have seen, have I been able to find any distinct or specific rules for taking the proper temperatures of mashing liquors; nor have I ever found, what may be called the most important, though least understood operation in the process of brewing, viz. fermentation, treated of or explained in such a manner, as to be any guide to a brewer under the various circumstances in which he may be placed.

In the following treatise I have endeavoured to supply these deficiencies, and have in the first place given such directions for the mashing temperatures, as I would fain hope cannot be mistaken.

In the next place, after fully describing all the different processes of fermentation, both good and bad, which during a long experience have come under my own observation, I have given the proper directions for the prevention of irregular fermentations, and the remedies which may be resorted to when such fermentations have occurred.

The art of brewing, notwithstanding the volumes which have been written on the subject, must be considered as still in its infancy, as a science. Many eminent chemists in England as well as on the continent have bestowed great attention on the subject, and have given such information to practical men as might have proved highly beneficial, had they been disposed to avail themselves of it. In most cases, however, if the beer can only be made to please their customers, brewers are averse to alterations.

All tastes, generally speaking, are acquired; and from use, we have heard of even rancid

butter being preferred to sweet. We also read that the Chinese prefer rotten eggs to fresh, as having a higher and to them more agreeable flavour. Taste, therefore, can be no criterion by which to judge of the wholesomeness or quality of beer, but as malt liquor may now be considered one of the necessaries of life among the working classes, it is of the greatest importance that they be supplied with such an article, as may not prove injurious to their health. An honest brewer, therefore, should not rest altogether satisfied with being able to please the palates of his customers, but should endeavour to produce what he knows to be a really wholesome and nourishing, as well as an agreeable drink.

I have endeavoured as much as possible to avoid all extraneous matter, confining myself principally to my own practice, and although the treatise may appear short, I trust that useful information will be found in almost every page.

Having no pretensions to literary acquirements, and never having before written for the

press, I must crave indulgence for the homeliness of my style. My aim has been to avoid mystery, and to convey useful information in language that shall be intelligible to all, and if I have succeeded in accomplishing this, my highest literary ambition will be gratified.

WILLIAM BLACK.

65, *Cornhill, London.*

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A

TREATISE ON BREWING.

INTRODUCTION.

So many practical and theoretical treatises on brewing have already been published, that the subject might, to some, appear to be exhausted. Many of these treatises, however, are too homely; while others so abound in scientific technicalities as to be altogether unintelligible to the general reader.

That brewing is a chemical process, is evident; and of course, in any scientific work on the subject, certain chemical terms must be used. In the following treatise, however, it is not intended to give any account of the production, or properties of the gases, or other chemical agents, farther than is absolutely required by the subject;

nor do I intend to give any history of the origin of beer, as I consider that to be unimportant, and moreover conjectural. It must be allowed, that during the last and present century, many valuable discoveries have been made in almost every science; while the art of brewing has remained stationary, or, as I am inclined to think, has retrograded, which may be atributed to the circumstance of few scientific gentlemen having turned their attention to the subject; while those who have done so, have not had it in their power to carry their researches to any useful result, on account of their want of practical knowledge. Some of them have applied for information to professional brewers, who, doubtless, from feelings of jealousy, have generally rather misled than instructed those who desired their assistance.

Another obstacle to improvement exists in the fact, that almost every brewer, in the course of a long practice, fancies that he has discovered some nostrum, by which he can make his beer better than his neighbours. These nostrums, though often worse than useless to the possessors, might, if freely communicated to more scientific inquirers, have some tendency to throw light upon the theory and principles of brewing; but they are uniformly kept secret, and thus want of the combination of science with practice

throws almost insurmountable difficulties in the way of investigation. Had it been otherwise, there is little doubt that, long ere now, the art of brewing would have been much better understood.

Having, in the course of an experience of nearly forty years, had occasion to work in many different breweries, I have uniformly observed, that the same process, particularly in fermentation, will scarcely answer in any two of them. In confirmation of this, I would refer to the well known fact that practical brewers, removing from one place to another, although they had in general succeeded in their former situation, have frequently failed in their new locality, notwithstanding that they have followed precisely the same system.

My intelligent friend, Mr. Robert Stein, who was long a practical brewer, and who has to my knowledge devoted as much attention to the science of brewing as any one, mentioned to me some circumstances corroborative of this opinion. He came from Edinburgh to London, and for three years tried every modification of process without success. At length, however, having succeeded in making proper alterations in the arrangement of his brewery, he experienced no further difficulty, but became uniformly successful during four years. He was removed by the St. Catherine's Dock Com-

pany, and it became necessary to adduce evidence, with regard to the hazard attending removal. He appealed to the difficulties which he himself had encountered and overcome, and adduced in corroboration many instances of the difficulties which other brewers had experienced in different situations: suffice it to mention two.

A large brewery was erected in Scotland for the purpose of making Porter, similar to that made in London. The Company did not succeed, although they employed a practical London brewer of great experience. The concern was sold, and became the property of a very successful ale brewer in the same town. He could not however make the same quality of ale, in his new and enlarged premises, and therefore wisely retreated to his old establishment, where he has been a successful brewer ever since.

The other instance occurred in Norwich, where a company had been successful, but they pulled down their old premises, and erected a more extensive and elegant brewery on the same site, where they never afterwards made good beer. Let me recommend it then to all successful brewers to let *well* alone. To all unsuccessful ones, allow me to say, alter — but alter with caution and circumspection — for it is evident that there is something connected with brewing, concerning which we are still very much in the

dark. When I come, however, to treat of the construction of a brew-house, I shall endeavour to give a theoretical opinion upon this point.

From what has been said, the difficulty of making sound, good beer, in all situations may be inferred; but the importance of producing it is universally admitted. Taste is no criterion of good beer. In many parts of the country the palates of the people have become so accustomed to foul, yeast-bitten beer, from having none else to drink, that were good, clean, wholesome beer substituted, it would be some time before they would relish it as much as the other; but once accustomed to the pure beverage, they would not readily relapse into their former taste.

But although I have only referred to country brewers, I am far from admitting that the capital is exempt from the same evils. How often does it occur that the first houses, periodically get, what is technically termed, "out of order;" in other words, make foul and bad beer, and continue to do so for weeks, without being able to account for, or remedy the evil, until a change in the atmosphere, or a change of yeast sets all right again!

I will however venture to assert that if a brew-house be properly constructed, these irregularities may be remedied in twenty-four

hours at any time. I am far from affirming that this foul beer will not *stand*, as it is called, or keep as long as that which has been well fermented, but it can never be rendered wholesome. Indeed, I have known brewers purposely give their beer, what they call a good bite of the yeast as a preservative.

I do not pretend to say that such foul beer will have injurious effects on the hard working labourer or mechanic, but it certainly will upon those of more sedentary employments. But of this physicians must be the best judges.

I will now proceed to give an outline of what I propose in the following pages. I have been, as I have already said, nearly forty years in the brewery, and have had opportunities of seeing and trying a great many different processes, and paid a great deal of money, for such information as it has seemed desirable to procure. All these processes I have endeavoured to trace to chemical causes; and should I fortunately be able to introduce such a system of general brewing, as may not only ultimately benefit the brewer, but produce a more wholesome beverage to the community, my end will be so far accomplished. I will not, however, pretend that I do not expect benefit to result to myself, from the publication of this treatise beyond the mere profits of the sale. On the contrary, as I affirm

that it is impossible to give such instructions as will cure existing evils in every situation, my wish is to have it understood that I shall be ready on moderate terms to give additional information and personal attendance to such as may wish to consult me on the subject. I shall now only briefly explain the plan of the following work, and shall then proceed to the details.

The only two gases, intimately connected with malting and brewing, are oxygen and carbonic acid, on which I shall very briefly touch. I shall then advert to electricity as connected with the process; and also to barley and malting; the site and construction of the brew-house; brewing, and formation of extracts; next, to fermentation, on which subject my remarks will be more copious than any I have met with in former treatises, considering that in this department the greatest skill of the brewer is required; since, unless we have a good fermentation, no good results can with certainty be reckoned upon. Lastly, I shall proceed to the storing and keeping of beer, a point of much more importance than it is generally thought to be. In the preceding observations my object has been to throw out instructive hints; and in what is to follow, no consideration shall prevent me from giving my opinions, in such a way, as I think

may be most beneficial, as well to the public as to the private brewer.

It is not my intention to treat of oxygen or carbonic acid gas, excepting as connected with malting and brewing. In malting, oxygen gas is absolutely necessary during the vegetation of the barley, or other corn, in its progress to that state in which it becomes malt. In brewing, a certain portion of it may be necessary in the commencement of fermentation, and in fact, many great chemists are of opinion, that, in the fermentation of beer, where no artificial ferment has been added, the process will not commence without it. In all other stages, however, of the process of brewing, the less we have of its action the better, for oxygen is the acidifying principle, and if we would turn beer into vinegar, we have only to expose it to the action of oxygen as contained in the atmosphere, in a moderate heat for a given time. If we wish, therefore, to preserve beer, the more closely we can shut it up, the better. I shall have occasion to treat more fully on this subject when I come to the storing and keeping of beer.

Carbonic acid gas, in a state of purity, is the destroyer of all animal, and, I believe, vegetable life; it is the only gas evolved during vinous fermentation. As, however, a particular account

of its production and properties more strictly belongs to a treatise on chemistry, I shall content myself with treating of it only as connected with beer. Immense quantities of this gas are disengaged by fermentation, and the beer afterwards retains, and continues to generate it, as long, I may say, as it is beer, of which, indeed, it is a component part; for beer, when entirely deprived of it, very soon becomes acid.

Many brewers, and even chemists, have thought that a good deal of spirit, or alcohol, is evaporated along with this gas, during fermentation, and contrivances have been made for condensing it, and again throwing it into the square, or fermenting vat. Thénard, however, is of a different opinion, and says that the quantity of spirit evaporated, if any at all, is not above a thousandth part, and, of course, not worth collecting. I entirely concur with him in this opinion, and should even go farther, and say that this vapour, when condensed, and again thrown into the square, must be rather injurious than otherwise. In fact, I once saw some of it which had by some means been condensed into a liquid, in his majesty's brewhouse at Deptford, in the course of some experiments on the subject; and the liquid was so nauseous, both to the smell and taste, that it could do the

beer no good when again incorporated with it. If a glass of the flattest beer be put into the receiver of an air-pump, the liquid, during the progress of exhaustion, froths up briskly until all its carbonic acid is disengaged. When afterwards tasted, it is quite vapid, and has lost all its flavour.

The sparkling property of beer, wines, and indeed all fermented liquors, is entirely owing to carbonic acid gas. When such liquids have been exposed for some time to the atmosphere, the greater portion of this gas escapes, and then the liquid drinks flat. It is, however, a popular, yet erroneous opinion, that the flatness is owing to the escape of the spirit.

OF ELECTRICITY.

It has long been the opinion of many eminent chemists, both English and French, that electricity is a powerful agent in fermentation, as well as in preserving or destroying beer. The late Sir H. Davy was decidedly of that opinion. In following up, therefore, the theory of so many eminent men, I trust I may be allowed to say a few words upon the subject. I myself had long the same impression, but had never bestowed much consideration upon it until my friend Mr. Robert Stein again drew my attention to the subject. If, then, I can distinctly prove its action in the first place, and afterwards point out a mode for counteracting its bad effects, I hope I shall obtain a better reputation than that of a mere theorist. Many strong indications of the action of electricity, not only on fermentation, but on the storing and keeping of beer, have come under my own notice; although I have not as yet been able to ascertain whether

it is the positive or negative state of it which affects the worts or beer. Among others, I shall select two instances; one with respect to fermentation, and the other regarding beer. In the summer of 1828, I was called into a town in Surry to superintend some brewings. On going there, I found the squares or gyle tuns imbedded in a ground floor. I at once expressed my disapprobation of this mode of placing them; having previously found a difficulty in summer brewing, with squares so placed. I, however, got on pretty well for two or three brewings; but on the morning of the 3rd July, (I had brewed on the 2nd,) I found the fermentation quite stationary, both with regard to heat and attenuation, and could not forward it by any means I had then in my power to apply. I felt satisfied in my own mind that these extraordinary appearances and effects were owing to the action of electricity; and this I stated to the proprietor of the brewery, at the same time predicting to him that we should very soon have a thunder storm. I then cleansed the beer by pumping it from the square into casks placed on wooden stillions about one foot and a half high, when the beer immediately began to work very well, and gained about six degrees in attenuation while throwing out its yeast. Early that same evening, as I had foretold, we had a most tremendous

thunder-storm. This, I am sure, will be attested by the proprietor of the brewery, although an after difference between us prevented me from going there again at the proper season, as I should have considered myself bound in honour to do, to give him my best advice at a time when it would have been more beneficial to him than it could be during summer, particularly with his squares so placed. The other instance was the following. I had a gyle of beer all stowed in one cellar in hogsheads or barrels: one portion of it, however, was placed on stillions, and the other on the ground without any bearers. The portion placed on stillions kept quite sound and good, while that on the ground, although it did not get absolutely pricked, was much more forward, and by no means so good. In confirmation of this, we may instance the fact that in dairies, where the milk is put into porcelain vessels and placed upon wooden shelves, it is seldom affected by lightning; but when contained in wooden or leaden vessels, and placed on the ground, it almost invariably turns sour. This shows that other liquids besides worts and beer are similarly affected by electricity. When I come to the construction of the brewhouse, I shall say something more upon the subject of placing the squares and other utensils; but I fear we shall not be able to

come to any certain conclusion with regard to the action of electricity on beer, until philosophers are better agreed as to the nature of that extraordinary fluid. Of this, however, we are pretty sure—that the preservation or destruction of beer depends upon electricity; and the most certain mode of preservation is to insulate, as much as possible, both the squares and all other utensils or vessels connected with the brewing or storing of beer.

ON MALT.

I NOW proceed to the selection of barley for malting. The best barleys for that purpose, are those called mellow, in contradistinction to hard or steely. The mellow barley, generally speaking, is thin-skinned, and when divided either by the teeth, or a pen-knife, the inside of the pickle appears quite white and floury. The steely barley may also be thin-skinned, but when divided in the same way, the inside has a blueish cast, something like rice, and this barley, although equally heavy, or even heavier than the other, will never produce such good malt, nor will the beer brewed from it, although of equal or greater gravity in the wort, ever be found to have the mellowness or richness of flavour produced by the other. Care should also be had, in taking in the barleys for malting, that corn of different weights be placed in different binns,

so that they may be wetted separately; as the heavier barley will not only require longer wetting, but will work differently on the floors. It would also be desirable, if possible, that barleys from similar soils should be wetted together. We always find, that in buying cargoes of barley grown on different soils, we can never make such good malt, as from that which is bought directly from farmers in the same part of the country. This proceeds from the difference of work on the floors.

I now proceed to malting, about the making of which, there are so many different opinions. With regard to wetting, the law allows, in my opinion, sufficient latitude for the wetting of any kind of barley, which, however, must be steeped not less than forty hours. The general mode of ascertaining when barley has been long enough under water, is, first, by its increase, shown by the dipping rod, and then by taking the pickles endways between the thumb and finger, the compressibility denoting its fitness for germination. Only a practical maltster, however, can ascertain this point. When sufficiently steeped, the barley is thrown (or, in some instances, drops by a large valve or socket) from the cistern into the couch, where it lies so many hours, also at the discretion of the maltster, not less, however, than twenty-six hours. It is then spread out upon the

floor to a thickness of from four to eight or nine inches, according to the season and temperature of the atmosphere, which latter is best ascertained by a thermometer placed by the side of the couch. The roots now begin to make their appearance, and great care must be taken to turn the corn gently occasionally, so as to prevent one fibre shooting out long, or wiry as it is called, a short bushy root being always desirable. No definite rules, however, can be laid down on this point; it must be left entirely to the skill of the operator.

We now come to the great point in dispute, viz. sprinkling the corn with liquor or water on the floors. Many are of opinion that this, about the third or fourth day, is absolutely necessary, while others assert the contrary. In my humble, and paradoxical opinion, both are right and both wrong. Should the corn be worked on a ground floor, it may perhaps imbibe as much moisture from the floor, as may be necessary for carrying on the vegetation; but when it is worked on an upper floor, where it can imbibe no moisture, but, on the contrary, where there must be great evaporation, no man of common sense will venture to assert, that sprinkling may not be absolutely necessary to carry on the vegetative process, without which it is totally impossible to make good malt.

In corroboration of this, I will mention a fact which came under my own observation. It happened in a malt-house where one half the wetting of barley was worked from the couch on a ground floor, and the other half on an upper floor. An intelligent officer of excise, who surveyed the premises, and who was at the same time well acquainted with the process, and also knew that no fraud was practised or intended to be practised by the trader, seeing the difference in the state of the corn then in process, on the upper and lower floors, said to the trader: "Your upper floors look very sickly; you will not see me here again for so many hours;" thereby intimating his knowledge of what was absolutely necessary to be done to keep the corn in a state of vegetation, without which the whole piece must have been ruined. He was afterwards quite pleased to find that his hint had been attended to. I have no doubt that this officer did his duty to the revenue quite as conscientiously as any self-sufficient blockhead, who would have acted very differently. I trust I have thus sufficiently explained my paradox. Many are of opinion that the best mode of working on the floors, is by the help of a thermometer, and by turning the floors whenever that instrument indicates a certain increase of temperature. I do not, however, coincide with this view of the

subject. I admit that a thermometer may be very useful in the hands of an inexperienced operator, but should he work by that alone, he will very often do more harm than good. I have no hesitation in saying, that there is as much mischief done by too many as by too few turnings: an experienced maltster having a sensitive smell, will know, immediately on entering a malthouse, whether the floors in general are in a healthy or unhealthy state. An experienced maltster, also, on examining his floors, generally thrusts his hand to the bottom of the corn in different parts, and takes up a handful; when the appearance, but more particularly the smell, will indicate whether the piece wants turning or not. When turning is requisite there is generally a kind of fœtid smell, which it is impossible to describe, but which a good maltster immediately detects, and turns the piece or not, according as his judgment may direct. I have already said that a short bushy root is always desirable, and the skill of a maltster will always be known by this criterion. As soon as the roots begin to appear, the spire or acrospire begins to grow down the back of the pickle, and as it proceeds the barley is turned into malt. The nearer therefore that this spire can be brought to the far end of the pickle, without growing out beyond it, the better will be the

malt. About the fourteenth day, generally speaking, the malt should be fit for the kiln; previously to its being sent to which, it is generally made thicker upon the floors, so as to come to a temperature of perhaps 75°. I should have stated that in the early stages a temperature of about 60° is at all times high enough. In drying malt on the kiln, the greater quantity of heated air you can throw in the better; you cannot therefore have too much draught, as that can at all times be checked if too strong, by throwing open the kiln hole door. When the malt is first put on the kiln, begin with a gentle fire, which you may afterwards gradually increase, until the malt is finished off. There are many different opinions as to the time and mode of drying off malt. I have seen it dryed off by a skilful kilnman, quite as well in twenty-four hours, as I have seen it done by others in four times that space. This, however, depends very much on the draught of the kiln, and the skill of the kilnman. When malt is thoroughly made before being brought to the kiln, I should think the time taken to dry it can make but little difference. When not thoroughly made, however, a skilful operator by a longer process may do a great deal of good.

In some parts of Nottinghamshire, the maltsters have a place at the far end of the floor near

the kiln, made lower than the other part of the floor, for the purpose of giving the malt a good soaking with water, about the twelfth day (as allowed by law) previously to its being brought to the kiln.

I have seen and drunk as fine ale brewed from this malt as I ever tasted, but not having malted on this plan, I am unable to say whether the practice is beneficial or not. I cannot see, however, why the law should prevent the trader from sprinkling his floors whenever he may think it necessary. It may at all times be done, under the inspection of the officer.

Malting I should define to be the natural process of vegetation, carried on by artificial means to a certain point, at which it is checked by artificial means, so as to produce the article called malt. In imitating nature therefore, it must be allowed, that the more closely we can follow her process the better.

How much is young growing corn after drought revived by a fine shower of rain! Must it not be the same, with corn progressing into malt, when parched by drought upon the floor? A gentle sprinkling with water will equally revive it, and freeing it from a nasty fœtid smell, restore it to a healthy growing fragrance.

As I am not, however, writing a treatise on malting, I shall conclude my observations on that

subject, by giving my opinion as to the best mode of selecting malt for a brewer. To a good judge, no hints are necessary upon that point. To a bad one, however, I would recommend a very old, and at the same time a very simple mode of trying it: viz. count out indiscriminately a hundred or two hundred pickles; throw these into a tumbler of cold water; the malt will all float on the surface, the unmalted corns will sink to the bottom, and the half malted corns will float endways or horizontally: you may thus at once discover the quality of the malt. If not more than five pickles in one hundred sink, and the remainder float on the surface longitudinally, the malt may be considered good; if otherwise, the contrary. You should then ascertain the weight, or get the maltster to guarantee a certain weight: about 40lbs. per bushel, or 160lbs. a sack, may be considered a fair average weight for good malt. Should it be *good* malt, however, every pound per bushel above that weight, will yield a much better gravity in the mash-tun than all the difference in price. If the barley should originally weigh 55lbs. per bushel, which it sometimes does, the loss of weight in malting is rather more than one-fifth; the same result obtains in lighter barleys. The value of malt therefore is determinable by its weight.

I have heard it asserted even by those who ought to have known better, that there could be no good malt weighing above 40lbs. per bushel; and I have known some as fine malt as could be made rejected, merely on account of its too great weight. I have already stated that barley loses rather more than one-fifth of its weight when made into malt. The heavier the barley, therefore, the heavier must be the malt — *and if it really be good malt,* it is the more or less valuable, according to its weight. There are fewer husks proportionally in heavy than in light malt, and according to the weight and paucity of husks, will be the extract in the mash tun.

I should say, that a fair average extract from malt of 40lbs. per bushel should be from 80 to 84lbs. by Long's instrument, or from 200 to 210lbs. by the excise instrument. I have, however, seen an extract of 240lbs. per quarter from malt of a very superior weight and quality. In most distilleries the grist is very carefully weighed into their mash tuns; thus enabling the masters to know whether their brewers have made the proper extract according to the weight of the grist. Any brewer who wishes to have a check upon his working brewer, or who wishes to go to work scientifically, ought to do the same. I have already said that 40lbs. per

bushel, or 160lbs. per sack, is a fair average weight for fine malt; let that, therefore, be the standard, and for every quarter of malt, let 320lbs. be put into the mash tun, which is easily done, either by weighing every sack before grinding — where it is ground into troughs — or by placing the sacks upon a scale, as done in the distillery, when ground into sacks. Every quarter of good malt thus weighed, should produce from 80 to 84lbs., or from 200 to 210lbs., and the master brewer can make his calculations accordingly. This also affords a complete check upon the operative brewer, who is sometimes apt, when he finds his extracts better than ordinary, to make no more beer than he does from worse malt. I have known a master brewer give orders that four barrels and one firkin of porter should be drawn from his malt per quarter, let the quality of the malt be what it may; and this brewer professed to rival the London porter, although his beer was at least 25 per cent. weaker, and mixed up with 25 per cent. more of nasty old beer. Were this method of weighing the malt into the mash tun adopted, a master brewer would also have an invariable check upon the maltster, as can be easily seen. I have long thought that malt ought to be bought and sold by weight, as in that case, the farmers would find it their in-

terest to clean and dress their barley better than they do at present, so as not to allow so many light corns to remain in the bulk, which adds to the duty, but deteriorates the malt, thus cutting both ways at the same time.

THE BREWERY.

THE SITE OF A BREWERY.

An airy unconfined situation, with a plentiful supply of pure water, should always, if possible, be selected for the site of a brewery; particular attention should, at the same time, be paid to the *quality* of the water. Should it contain any mineral, it must be very unfit for brewing, and unless a supply of soft water can also be had, you had better look out for another site. Soft and hard waters are so well known by these names, that I should consider no chemical description of them necessary, in a treatise on brewing. Most brewers use the soft water; yet some prefer the hard. Hard water in my judgment never obtains so good an extract from the malt; many, however, think that the beer brewed from it is not so apt to *fret*, as that which is brewed with soft. I am, of opinion, that a good fermentation, and subsequently good storing, will at all times prevent *fretting* in the beer. I should therefore recommend soft water.

That which runs over chalk or limestone, and which is free from sulphate of lime, (*gypsum*) is best. Where the water is hard, I would recommend throwing a little vegetable alkali (*subcarbonate of potash*) into the liquor in the copper before mashing. In adding this salt, take care that the water does not turn turmeric paper red; should it do so, the salt is then added in excess, and will do harm.

I do not attribute the flavour of either the Burton or Scotch ale to any thing in the water.

CONSTRUCTION OF THE BREW-HOUSE.

In building a brew-house, care should be taken to keep the boiling and mashing departments as separate as possible, from the cooling and fermenting departments. This arrangement will prevent the steam from retarding the cooling of the worts, and also from coming into collision with your fermentations, which has often a very injurious effect.

I always consider that where there are not two coppers, it is advantageous to have the one rather too large than too small, as it gives much more facility to the operations of mashing and boiling; a copper back is also indispensable where there is but one copper. This back should be so constructed, that you may either throw

the worts into it, or directly into the boiler at pleasure. It should also have a communication with the mash tun, so as to conduct the liquor or raw wort, directly from it to the mash tun. I would next recommend that both the mash tun and underback, should be above ground, and placed on wooden frames, or in other words as much insulated as possible, to prevent the action of electricity. I have not the least doubt, that, in summer, *foxing* or tainting of the taps often happens between the mash tun and copper from the action of electricity; and when this happens, although it is possible, in some measure, to cure it, the beer will never be so good, as when the worts are originally sound. It is of importance that the worts should at all times be for as short a period as possible exposed to the action of atmospheric air. The coolers therefore should be spacious, and each should run into the other. Fans are very useful not only for driving off the steam, but for keeping the worts in constant motion, by which the risk of getting tainted is considerably less than when they are allowed to remain quiescent. A proper refrigerator for the worts is also almost indispensable in summer; to have these refrigerators, however, properly constructed, is a point of considerable importance.

After my remarks on the effects of electricity, I need hardly say how I would recommend the gyle tuns to be placed; most certainly as much insulated as possible; in no way connected either with the earth or the walls, but if placed upon baked wood the more desirable. You should also possess the power of shutting them up close, or giving them a little air at pleasure. I once saw a gyle tun placed directly below an iron jack back. A few minutes after the boiling worts were turned into the jack back, the head on the top of the beer, in this gyle tun, which was previously looking vigorous and healthy, fell down and did not rise again.

I am afraid that there is too much of iron, and other metals, in some of the larger establishments. Of that, however, the parties concerned must be the best judges. I attribute the failure in the process, at the new brew-house in Scotland, mentioned in the introduction, to the neglect of some of the precautions I have suggested. Indeed I should think it can be traced to no other cause.

I would also recommend the cleansing stillions to be made of wood, so that the mains from the gyle tuns, may have no connection with the walls or earth, during the process of cleansing the beer.

In short, if the opinions of some of the most

eminent chemists in Europe, may be relied on, too much care cannot be taken, in placing all the utensils connected with the fermenting and storing of beer, in as insulated positions as possible. I am aware that I have broached a somewhat new doctrine, with regard to the operative department of brewing, but referring, not merely to my own practice, but to the authority of Sir H. Davy, and others, — the most eminent men in Europe,—I hope I shall be acquitted of presumption, when I say that it deserves attention; and I have not the least doubt that when put in practice, the most beneficial results, both as regards the quality and preservation of beer, will ensue.

Having said thus much of the construction of a brew-house, and the placing of the utensils, and given what I think will be, to any scientific man, pretty strong reasons for such arrangements, I care not if I may be met by the trite observation of " There has been very good beer brewed here before, and such as has generally pleased our customers, and I can see no good reason for making any alteration." The answer I should give, would be: ' Although there may have been very good beer brewed here, have you never brewed any bad beer, and such as has not pleased your customers?' " Oh, yes!" will be the rejoinder, " we have

certainly brewed some bad beer, but that is always the result of carelessness. If good beer is brewed at one time, why should it not be good at all times?" My reply would be: 'In the first place, the placing of your squares or other utensils, and many other causes distinct from carelessness, prevent it.' I have already said that tainting, or unsoundness in worts, is often produced by the action of electricity, between the mash tun and copper. How often does this happen in summer, without our being able to trace it to any particular cause! I therefore maintain, that probability at least is in favour of my hypothesis as to the effect of electricity. Wherefore, then, incur any risk, since the expense of raising the underback a little distance from the ground is comparatively trifling?

Another cause may be found in the sluggishness or unsoundness in the yeast; but this will be more fully discussed when we treat on the subject of yeast.

OF BREWING.

THE first thing to be attended to in the brewing department, is cleanliness in all its branches. From want of cleanliness the worst and most irretrievable consequences may arise; such for instance, as tainted worts, &c. I have known a whole brew-house contaminated by a small portion of the worts remaining in the wort-pumps from one brewing to another, and it was only at a very considerable expense that the evil was at last remedied.

It has long been a disputed point, whether malt gives the best extract, when ground with stones or rollers. When the malt is of very fine quality, I have never perceived any difference. When, however, it is steely, stone grinding will give the best extract. There are also various opinions as to the fineness or coarseness of the grist, or grinding, some contending that if the

pickle be at all broken by the rollers, the malt will not only give as good an extract, but that their taps will spend finer; a point to which many attach great importance. I am, however, of opinion, that finer grinding will produce rather better extracts; and if the first liquor be properly taken, and allowed to remain long enough on the goods, there will be very little difference in the fineness of the worts; at all events, they will be quite as bright in the jack, or hop back, and perhaps also a little stronger, than those from the coarser grist.

The next subject we shall discuss, is the heat and quantity of liquor to be turned over the first mash. This is a point of very great importance, as I may say the whole after success of the brewing depends upon it.

In my judgment the whole of the extract should be made in the first mash, all that is required afterwards being merely to wash out what remains in the goods. Those who go farther may do more harm than good, as they only obtain mucilage, which instead of enriching, impoverishes the beer. That the extract is obtained in the first mash, is distinctly shown in regularly mashing with the same quantity of liquor, when by comparing the gravities of the different taps it will be seen, that you go on in regular gradation washing out the extract, until

you get all that you can. Many people make a very great mystery of their heats for mashing all through. I hold the heats after the first mash, to be a point of very little importance, if you get your extract properly in the first instance. Others say, that high or low temperatures in your mashing, make very great differences in your fermentations. All that I can state is, that I never found it so. I do not say so, however, with regard to the first mash, because unless you take a proper temperature for that, you will not make a good extract, but on the contrary, perhaps, produce an unsound one, which may materially injure your fermentation. After the first mash, however, I will allow any — the first brewer in England—to dictate my heats from 180° to 204°, and I will undertake that both my extract and fermentation shall be quite as good as his, and either slow or fast as he may choose.

I shall now proceed to give such certain rules as to the temperature of the first mash, and the quantity of liquor to be turned over, as I think no one can mistake. I believe it is an admitted point that if your first taps when half run down, show by the thermometer a temperature between 138° and 152° you cannot be far wrong; I shall take 145° as the medium. For pale beers therefore your taps should be from 145°

to 152°, allowing a range of seven degrees; for brown beers your taps should be from 138° to 145°. All we have to do therefore is to regulate the heat of the liquor, so as to produce this effect.

To accomplish this, you must first ascertain by the thermometer, the heat of the grist in the mash tun, which may range from a temperature of 32° to 80°, according to circumstances, and the season of the year.*

I shall take, again, a medium, say, 58° for the heat of the grist; a temperature then of 175° for pale beer will generally make your taps spend within the given range, and 160° to 165° for brown beer will do the same. We never, however, require a difference in the temperature of the mashing liquor of more than from 10° to 15°, let the temperature of the malt be what it may. I always consider that a stiff mash in the first instance, ultimately produces the best extract from the malt: I should therefore say, that if we have sufficient power, which a steam engine and mashing machine always command, we should at first turn on only about a barrel and a half per quarter. After having mashed a sufficient time, which may be from forty minutes to an

* Malt is in my opinion the better for being ground one or two days before brewing, as it will produce a better extract; and when ground it should be excluded as much as possible from the atmosphere.

hour, according to your strength of machine or oars, dip a thermometer into the goods in your mash-tun, and should you find the temperature too low, so as that your taps would not run within the given range, turn on half a barrel more per quarter, at any temperature which may be requisite to bring the whole up to the desired heat. You now run no risk of setting the goods. If your thermometer shows, on the contrary, too high a temperature, adopt the reverse mode, viz. turn on half a barrel per quarter, at such a temperature as will bring your taps down to the desired range: the liquor, however, so introduced should not be below 150° of heat. The lower temperature should never be used unless the goods be partially set, and the only use of reserving the half barrel when first turning on, is to give you a certainty of having a proper temperature for making the extract. It is always desirable in turning over your first quantity, to be rather under than above the mark, as it is better to increase than lower your temperature in the first mash. I trust I have thus laid down such rules for the first liquor, as no one can mistake.

The next thing is the time of standing. I would always recommend for the first mash at least one hour and a half. Two hours in cold weather will do no harm. Half an hour's standing is quite enough for any of the subsequent

mashes. The process book subjoined to this treatise will show the different quantities of liquor, to be turned over for the different qualities of beer, in the subsequent mashes.

Having alluded to "setting the goods," I think it proper to mention that the safest practice to avoid it, is to begin mashing at a low temperature, and afterwards to raise the heat to such a pitch as may be found necessary to form the extract, from the particular malt made use of as before directed; the change of colour which takes place, will give a sure indication of this to every practical brewer.

Many brewers, when they try, by the advice of others, different temperatures for mashing, and find that their fermentation does not get on well, immediately attribute their want of success to their change of heats; but it may be referred to a variety of other causes. In short, in brewing we very often attribute effects to wrong causes, and thus confirm ourselves in error.

So able a treatise on the subject of taking the lengths, has been written by the late Mr. Richardson of Hull, that I need say little on that subject, presuming that few brewers are without a copy of it. I would therefore beg leave to refer them, on that subject, to his treatise.

The top of the goods in the mash-tun should

be sprinkled over with a little dry, ground malt when you have done mashing, as it will effectually prevent the rise of steam, and the consequent reduction of the temperature of the goods; that is, the malt in a state of infusion.

OF SPRINKLING OR SPARGING.

Many of our best brewers have now adopted sprinkling or sparging, or, in other words, draining liquor through the mashed goods, in preference to mashing again. This mode of working has certainly many advantages to recommend it. In the first place, it saves labour; in the next place, when we wish to make very strong beers, either ale or stout, we can more easily throw in the desired gravity by sprinkling than mashing. I should, therefore, on all occasions of brewing very strong beers, resort to sprinkling.

When beer of not more than 24lbs. gravity is brewed, with a raw wort to follow, it matters little which mode is adopted. Where there is no raw wort, however, sprinkling will always be found most advantageous. Some prefer running off their first mash before they begin to sprinkle: others, after having thoroughly mashed with one and a half barrel per quarter, as formerly directed, immediately begin sprinkling

from a temperature of 190° to above 200°. This, however, must be done very slowly, and the liquor should be made, by means of an apparatus for the purpose, to descend like rain all over the top of the goods; care must also be taken that the goods keep rising as the liquor is going on. When about half a barrel more per quarter is turned on in this manner, which may take from one to one and a half hour, the tap is immediately set: you must then keep sprinkling and running off precisely the same quantities, gradually decreasing your heats, until you have got all you want for your strong beers. Afterwards continue the same process, either for small beer, or raw wort, until you have exhausted your malt. This process goes very far to prove what I have before stated, that the whole extract is made by the first mash, and that the subsequent mashes merely wash that extract out. By means of either a dipping rod, or any mark in the mash tun, you can regulate your running on and off in equal quantities during process.

OF BOILING.

About this, also, there are various opinions: many think that long boiling, particularly of the

last worts, tends to make the beer keep sound. I am not aware, however, of any preservative quality, imparted by long boiling; but, on the contrary, I have seen grey beer produced, after very long boiling; the result, probably, of some injurious extract from the hops. The high colour produced by *bad boiling*, is a mere eye sore. The brick red I have seen come upon very pale worts, during fermentation. I have also seen ale, intended to be pale, made of a brick-reddish colour, after too long boiling. Whether this proceeded, however, from the long boiling, or from the copper not being altogether safe before turning out, I cannot say. Long boiling undoubtedly adds to the strength of the worts by evaporation, and thus enables us, where there is no raw wort, to take a few barrels more from our goods. I doubt very much, however, whether the expense of coals and time does not more than counterbalance the advantage.

In 1832, I brewed a small gyle of pale beer for the India market. The first worts were boiled one hour, the second one and a half hour. I beg leave to subjoin the report made upon it in Calcutta.

"Calcutta, 8th August, 1832. — Report on two hogsheads of Black's pale ale, examined in the custom house godowns of Messrs. Lyall,

Matheson and Co.—Two hogsheads of Black's pale ale.—This pale ale, of superior quality, is well adapted for the India market, both in colour, body, and flavour.

(Signed) JOHN BROWN AND CO.,
Coopers to the Honour able Company.

Another lot of this same beer went to Messrs. Watson and Co., and I beg leave, also, to insert a short extract of their letter to me, of date, Calcutta, 9th April, 1833.

"We wrote to you on the 17th of November, to which we refer you.—Your beer is now ripe, and confirms what we then wrote you; it is really most excellent, and, as such, we are disposing of it in small quantities, so as it may be known."

This, at all events, proves that long boiling is not essential to the preservation of beer; and I have come to the conclusion, that long boiling can do no good, but may do harm. Unless, therefore, longer time should be required for strength, I should say, that one hour's boiling will sufficiently break the first worts, and two hours, at the utmost, will do the same by any other wort.

OF FERMENTATION.

I now come, to what I consider to be, by far

the most difficult, and least understood part of the process of brewing, viz. fermentation; about which we are still very much in the dark. I trust, however, that in the following pages, I shall be able to throw a little new light upon the subject. My views may, in many caes, differ from those of others who have preceded me; but if, upon trial, my system should prove to be more beneficial, my purpose will be accomplished, and nothing will give me greater pleasure, than to find other operators, better informed than myself, improving upon my suggestions.

Fermentation is undoubtedly a chemical process, by which, with the assistance of an artificial ferment, the component parts of worts are changed and more intimately combined, and thus converted into beer. I am of opinion, that, upon a good or bad fermentation, depends all the flavour, as also all the preservative qualities of the beer. I shall therefore endeavour to give all the information on the subject I have been able to gather, in the course of nearly forty years' experience in the brewery: and, as I have not seen, I may say, any regular treatise on this most material part of the process, in any former publication, I shall be the more copious in this.

Unless worts go into the copper sound, they cannot come sound out of it, and no after treat-

ment can thoroughly cure them, although they may, to a certain extent, be ameliorated by a skilful brewer. The worts, also, often get tainted in the coolers, by lying there too long, particularly in warm or close weather. If we have not a sound wort, we never can have a thoroughly good fermentation, although that also may be bettered by proper means. Every artificial aid, therefore, ought to be resorted to, for the purpose of cooling the worts as soon as possible, so as to prevent the bad effects of being too long exposed on the coolers, and thereby imbibing oxygen from the atmosphere. I should, in the first place, strongly recommend fans, as they not only drive off the steam, but keep the worts in a constant state of agitation, which is a great preservative against foxing or tainting; and if a small portion of the dreg from the hops be allowed to run into the coolers with the worts, it will assist in preserving the latter, while it will prove no detriment, if swept along with them into the square. This is, I know, quite contrary to the opinion of many brewers; but I have no hesitation in saying, that it will be found to be beneficial, rather than hurtful in the fermentation. I would also strongly recommend refrigerators, both for cooling the worts and for regulating the temperature in the squares. Applied to the latter, however, they

may more properly be called regulators. In summer they are particularly useful, and without them I would never undertake to be answerable for the result of my work. It is stated by many eminent chemists, that the acetous fermentation commences, and is best carried on at a temperature of from 75° to 90° or 100°. Such high temperatures should therefore be carefully avoided in the vinous fermentation, as we do not wish to brew vinegar, or what would soon become vinegar, by exposure to the atmosphere: we will, therefore, for the vinous fermentation, take a range of from 50° to 75°, stopping before we can run any risk of getting into the acetous.

This range, in my humble opinion, is quite sufficient for the acquirement of any flavour or attenuation, that may be wanted in either ale or porter. I have heard of brewers commencing their fermentations at 75° or 80° of heat, and cleansing at, or above 100°; thus carrying on the acetous fermentation during the whole process. The beer thus brewed, would only require a little exposure to the atmosphere to make it good or bad vinegar: I should therefore doubt, whether, even when drank immediately, it can be so wholesome, as when fermented at the vinous temperatures.

Others assert, that certain flavours can only

be obtained by commencing their process of fermentation, at what I should call very high temperatures, viz. 65° or 70°, and gaining heat during the process, Richardson says, as high as 100° I maintain, on the contrary, that not only a better flavour of beer, but a more preservative quality will be gained at temperatures of from 50° to 75°, never exceeding 75°, during the whole process of fermentation. There is an old saying, "The proof of the pudding is in the eating." Let any of these gentlemen brew a gyle of beer at these high temperatures, while I brew one to compare with it, cleansed at or under 75°, and I will stake the price of the gyle, that the beer fermented at the lower temperature shall not only be of better flavour, but keep sound, while the other becomes pricked.

I speak here from dear bought experience. Is it reasonable to expect, that beer fermented at acetous temperatures can be so good, or keep so sound, as beer fermented at vinous temperatures? On very small scales, however, where the squares or gyle tuns are much exposed to the cold, we cannot venture to get below 60°, or even sometimes 65°; but I would in no instance, if possible, go above 75°. To regulate our fermenting temperatures, therefore, refrigerators, or regulators, are absolutely

necessary in the squares: I have invented and used floating ones, suspended by a rope or chain from the top of the square.

They are made at a very small expense, and, in my opinion, answer the purpose better than any of the most expensive now in use: for this I could give very substantial reasons, of which I will adduce one. We all know that liquids, as they cool, get specifically heavier, and thus, the portion first cooled, on the surface, will sink down, while that which is warmer and specifically lighter will rise up to supply its place. This, therefore, acts more gradually, and of course better, than when the refrigerator is carried round the inside of the square; the wort is, at the same time, all kept in motion from the rising of the warmer, and sinking of the cooler parts; which I also consider to be advantageous. Refrigerators, when placed at the bottom of the square, do very little more, for a long time, than cool the wort to their own level, unless the whole be kept in a constant state of agitation, by means of a rouser.

OF HOP DREG IN THE WORTS.

Many brewers are very much afraid of allowing any of the dreg from the hops to go into

the coolers. I must confess that I at one time was of the same opinion, merely from having heard from others that it did harm. I continued of this opinion, until better instructed by my friend Mr. Robert Stein, to whom I am indebted for much useful information on the subject. He made me, on one occasion, when from causes to be hereafter explained, I certainly was very unsuccessful in my fermentations, throw a quantity of the hop dreg into the coolers along with the worts, and afterwards sweep the whole into the square. Instead of hurting the fermentation, it made it decidedly more vigorous than before, and ever since I have successfully pursued the same practice.

The hop dreg is also a great preservative to the wort in the coolers. We all know that worts while they remain on the hops, are much less liable to get tainted than when drained off: precisely on the same principle, a little of the dreg or *fecula* of the hops, is a preservative in the coolers, and the greater the quantity that goes over, the less is the risk of taint. I sometimes therefore rouse the hops in the hop back, while the worts are draining off, for the purpose of throwing over more of the *fecula* into the coolers, than would have otherwise run over, along with the worts. I well know the prejudice that

exists on this subject, but I boldly start an opposite doctrine, in the full confidence, that the experiment once made, will ensure the permanent adoption of my system.

OF YEAST.

Yeast when taken out of the stillions, and allowed to stand about in reservoirs or tubs, begins to work and fret itself, in such a way as to expend its strength; and thus becomes unfit for carrying on a regular fermentation in the squares.

It should therefore at all times (if there be not too long an interval between the brewings) be allowed to remain in the stillions with a portion of the drawings, until wanted for use. The drawings should then be carefully removed in the usual way, and the yeast taken up. It is a point of the utmost consequence, that yeast should at all times be quite fresh, and free from any acidity. I believe that a great deal of mischief happens in summer, from this point not being sufficiently attended to, and I have often had occasion to recommend the use of lesser quantities of malt, and more frequent brewings to accomplish the preservation of the yeast. Where, however, this cannot be done, I would advise

that, when the yeast must be taken up from the stillion, it should be placed in the coolest part of the work, and a quantity of cold liquor thrown over it, (a piece of ice would be better) to prevent its fretting. If the yeast should have to stand long, this cold liquor should be occasionally poured off and replaced, and the yeast will thus be kept infinitely more sound and fit for use, than it would otherwise be.

The next thing we have to consider, is the quantity of yeast necessary to be used in fermentation. The most generally received notion I believe is, that the stronger the beer, the less yeast is necessary. I totally differ from this opinion, and contend that if an artificial ferment be at all necessary, the quantity should be in proportion to the work it has to do; in other words, in proportion to the saccharine matter to be attenuated. I do not say, that the same attenuation may not perhaps be ultimately obtained by a smaller quantity of yeast, but this is leaving in a manner to chance that which may be effected with certainty, in a much shorter time, by a different process; and I maintain that beer, both ale and porter, may be produced equally as good, by what I would call a short process of fermentation, as by the longest process now in use. I am also of opinion, that

the beer brewed by a short process will be found to retain its vinosity and soundness much longer than the other.

Indeed, I firmly believe, that the long process in fermentations of the Scotch ales, and the after exposure of the beer to the atmospheric air, to flatten, as it is termed, is the great cause of its so often going off, or getting unsound in summer. The exposure of beer to flatten, is without doubt a partial carrying on of the process for making vinegar; for vinegar is generally made by exposure of the liquor to the atmosphere, for the purpose of its imbibing oxygen, the acidifying principle.

I have seen the regular acetous fermentation actually commenced, in a gyle of beer exposed in an open tun in this way to flatten it, and had it remained there much longer, it must have eventually become vinegar. The quantity of yeast, however, to be used, either for a long or a short process of fermentation varies so much according to seasons and circumstances, that it becomes very difficult to lay down any certain rules concerning it. I have already said that it is hardly possible to carry on precisely the same process of fermentation in any two different brew-houses, and this sufficiently accounts for the want of success of many brewers when they change their situations. Brewing

with hard or soft liquor makes a difference; the hard requiring more yeast. High and low pitching, the situations of the squares, and various other circumstances will also cause a difference. In summer one-half the quantity used in winter may often be found sufficient, and the quality and vigour of the yeast itself has to be taken into account.

I shall, however, I think, be able to lay down such rules as may easily guide an experienced brewer, should he at any time find himself in difficulty; and to the private brewer I would always recommend an ample quantity of good yeast and early cleansing. Using yeast by measure should never be attempted, as there may be sometimes many pounds difference in weight per gallon.

Before proceeding further, however, I must endeavour to describe what I should call a regularly good fermentation. In all regular and good fermentations there should be five distinct changes. In the first we see a substance like cream forming all round the edges of the gyle tun: this extends itself towards the centre until the whole is creamed over, which is the first change. There next appears a fine curl like cauliflower, which likewise extends all over the square, and according to the strength and appearance of this curl you may expect a good or

bad fermentation: this I call the second change. What is technically called the stomach or vinous vapour now begins to be smelt, and continues to acquire strength until the process is concluded, and by the power and vinosity of the smell of this vapour and the regular attenuation of the wort, the vigour of the fermentation may be determined. An experienced brewer is very much guided in his operations by the smell of this vapour. I shall not here give the different periods at which the above and after changes should take place, as they may vary a little in ale and porter. They will be found, however, in the process table at the end of this treatise.

The third change is the cauliflower or curling top, rising to a fine rocky or light yeasty head; this should after a certain time fall down a little, which I call the fourth change. The head should, lastly, rise to what is called close-yeasty, having the appearance of yeast all over. About this period the gas becomes so powerful as to puff up occasionally in little bells or bladders about the size of a walnut, which immediately break; sometimes the gas escapes without bursting those bells; but in either case it is of very little importance, provided the bells, when they do rise, appear bright and clear. If, however, they should be opaque or whey-coloured, you may rest assured there has been some unsoundness

in your wort, and no time should be lost in endeavouring to ascertain the cause, in order to avoid the evil in future.

The whole art and mystery, therefore of judging of the necessary quantity of yeast, is to give such an allowance as will carry your fermentation through those five changes at the regular periods, and at the same time regularly gaining heat. As I have before said, however, the quantities vary so much according to circumstances, that no definite rules can be laid down upon the subject. But the operator, if he be guided by the directions I have given, can have very little difficulty, in finding out the different quantities to be used at the various seasons, and also almost under any circumstances.

Should your fermentations, however, unfortunately go on irregularly, you may rest assured that it must proceed either from some unsoundness in the worts, or the bad construction of your utensils, by which they are exposed to the action of electricity.

If you find you have given too little yeast, you can do no harm by adding a little more during any stage of the process. In some brew-houses *feeding*, as it is called, or adding a little more yeast, when the light yeasty head falls, may be found to be uniformly necessary. Yeast, however, should never be used, without

being previously mixed, and set working with a little of the wort; and should the yeast be sluggish, the wort should be added at a temperature of 80° or 90°. The quantities I have been in the practice of using will also be found in the process tables.

If your yeast should be of such a quality as to act but sluggishly in the square, you are always exposed to the risk of your beer becoming yeast-bitten or foul. The more your yeast lies about and frets, before being used, the more likely it is to produce this effect. And if you should at any time find your fermentation at a stand still, that is, not making any progress either in heat or attenuation, you are pretty sure to get yeast-bitten, if means be not immediately taken to set it again in motion by an addition of yeast. Should you, however, use the same sluggish yeast you will make it worse. But if you have, or can procure good light yeast immediately thrown off, from a more vigorous fermentation, you may use it in any quantity without risk, until you again set your fermentation in action. Previously to this, however, a little flour of malt sifted all over the tun will be found a great assistant. Dr. Thomson states that if you skim off the whole creamy-like top, which floats on the surface of yeast, after standing a short time in a vessel, the remain-

der will be almost good for nothing, and this I know to be the case. I would, therefore, recommend, that when old yeast must be used, you should take what you want from as near the surface as possible, and always mix it up with a little hot wort, and see that it has begun to work before throwing it into the square.

CLOSE FERMENTATION.

Many are of opinion, that their fermentations are better when the gyle tuns are shut up close, so as to prevent any contact with the atmospheric air. In as far as regards the atmosphere this opinion is correct; but when a fermentation is going on vigorously, there can be no connection with the air; the rising and escape of the gas totally preventing it. Carbonic acid gas is heavier than atmospheric air (its specific gravity being 1.527, air being 1.000,) and while it floats on the surface of the beer, *constantly* making its escape, atmospheric air can scarcely interfere.

About 1823-4, Mr. Gray, of Westham, on Madame Gervais' principle, attempted to introduce close fermentations into this country: I believe it was tried in several places, but I have never heard of its being permanently adopted. My objection to very close fermentation is, in the

first place, the difficulty of seeing into your squares which, in a common gyle tun, you can do without trouble, every time you pass. In the next place, the gas, when in some measure compressed, prevents the rise of the head upon the worts or beer. I would, therefore, never shut up very closely, except to keep out cold. It may do no harm, but I never saw very close fermentations attended with advantage, particularly when they are languid.

INERT FERMENTATION.

The next kind of fermentation I will mention, is what I call inert and erroneous, perhaps the most deceitful of any; and very few, except the most experienced brewers are aware of it. This fermentation has, sometimes, all the appearance of proceeding remarkably well, in the square, and an inexperienced brewer would be quite satisfied that every thing was going on perfectly right. The beer, however, will always be mawkish and heavy, and almost without any vinosity, although the attenuation may have been carried far enough. This inert fermentation can only be discovered from the taste of the wort, which is always mawkish, and the want of vinosity and pungency in the smell of

gas, rising from the square. It follows, therefore, that a good brewer must always be possessed of an accurate taste and smell, without which requisites, it is impossible he can judge correctly of his processes. Whence this imperfect or inert fermentation proceeds, I have never been able to discover: I should suppose, however, that it must arise either from unsoundness in the extract, or from the action of electricity; or, it may probably proceed from the bad quality of the yeast. As it is the most deceitful, and difficult of detection, I consider it the most dangerous; and I fully believe, that more indifferent beer is produced by this erroneous process, than by any other means. How often do we hear brewers blamed for their beer being mawkish, when they cannot in any way account for it? They may rest assured, however, that in nine instances out of ten, it proceeds from an inert fermentation, and not from want of boiling, to which it is generally attributed.

I cannot point out any other tests of the result of this inert fermentation, than those I have already mentioned, viz., mawkishness in the taste, and the want of vinosity in the smell. The only remedy for it, is the promotion, of a more vigorous fermentation. I shall at present, however, say nothing more upon this subject;

but when I come to treat of *practical brewing*, all the different anomalies in fermentation which have come under my own observation will be described more at length, and the proper remedies pointed out for the prevention or cure of such fermentations as may require it.

WINTER BREWING.

A GENERAL opinion has for a long time prevailed that October is one of the best months in the year for brewing all sorts of beer. I can only say for myself, that I have often found it quite the reverse, and that I have had quite as much difficulty in getting my fermentations to go on properly during that month, as during any other month in the year. Whether this may have proceeded from the muggyness of the weather, or from the falling of leaves and other vegetables into the brewing liquor, which might cause a putridity, I cannot determine. In noblemen and gentlemen's families, where they brew their own beer, I believe the month of October is still preferred for that purpose. I hold that, however, to be no criterion, as they commonly brew with pure spring *liquor*. The goodness of *their* beer, generally speaking, depends fully as much on the care of their butler, as on that of their brewer. The beer being brewed excessively strong is always left by the brewer in a state of unattenu-

ated wort, as a saccharometer would very readily show. It has then to undergo a second fermentation before it is fit to be drunk, and upon this second fermentation being well or ill conducted by the butler, depends the quality of the beer.

The worts, being originally very strong, retain a sufficient quantity of saccharine, after the brewer has done with them, to prevent the approach of the acetous fermentation. When the second fermentation, therefore, comes on, the skill of the butler is required to give vent when necessary, and sometimes to rack the beer into other casks, in order to stop the fermentation when he finds that it has proceeded far enough. This, however, is trusting a great deal more to chance, than can possibly be allowed in the brewery. And as the beer, in general, is not quite so strong as that which is brewed in noblemen and gentlemen's families, there would be less chance of its undergoing the second fermentation so well as the other, and the beer would of course get pricked. I would never, therefore, recommend the month of October as the best brewing month, particularly for keeping beers. Fine open frosty weather will always be found more favourable to fermentation, and such weather I would always select for brewing

keeping beers. Indeed I am pretty sure that the beer brewed in frosty weather will always be found sounder than that brewed in muggy weather. In frosty weather the fermentations, if other causes do not prevent it, will always be vigorous and healthy; and a vigorous and healthy fermentation is indispensably necessary, for all beer intended for keeping or exportation to a warm climate. I have often seen in the month of October more inert fermentation than in any other month in the year. And, as already stated, this fermentation is the most deceitful which can occur.

I would, therefore, defer brewing any keeping beers until it can be done in frosty, or at all events cool open weather, which may be expected in December, January, February and March. During these months all *keeping* beers should be brewed, and when brewed they should be exposed as little as possible to the action of atmospheric air. I would always, however, for *keeping* beers prefer a moderately quick and vigorous fermentation, to a very slow fermentation: since the former imparts, not only more vinosity, but a stronger preservative quality to the beer. For *running* beers, however, it is of less importance, and many are of opinion that the beer acquires more fullness from the slow

than the quick fermentation. But of this, I am very doubtful, and leave every one, in that respect, to judge for himself.

The Scotch ales are no great proof of the preservative qualities of a slow fermentation, how much soever they may be agreeable to the prevailing taste, when mild and new.

SUMMER BREWING.

In summer it has always been found more difficult to brew good beer than in winter, so much so, that some time ago, very few brewers possessed of capital brewed in summer. Now, the public taste has so much altered with regard to beer, that even the largest establishments, find it necessary to brew almost throughout the year; and art, by means of fans, refrigerators, &c. has enabled them to do so with greater success, than they could have done before the invention of these auxiliaries.

Even now, however, with the assistance of all these new inventions, summer brewing is very uncertain and precarious, and no one thinks of brewing more than absolutely necessary for immediate draught.

I have always found, that the more speedily the whole process was carried on in summer, the better it succeeded. The taps or raw worts, therefore, should never be allowed to remain

any time in the underback, but should be immediately pumped up into the copper, in order to gain heat; nor should any time be lost between your different mashings: in fact, every thing should be carried on as speedily as possible. In summer I would always prefer the sprinkling mode of brewing, provided there are two coppers, so as to carry it on from beginning to end without intermission. Raw worts are always dangerous in summer, unless the greatest possible care be taken to keep them sound, and it sometimes requires a good judge to know whether they are so or not. If unsound it is much better to throw them away than to use them, notwithstanding the apparent loss. Long fermentations in summer are always hazardous. Apply, therefore, such quantities of yeast, as may be found necessary to carry on the fermentations rapidly; never beyond the second day after brewing. To do this, however, a regulator in the tun is absolutely requisite to keep your temperature within due bounds.

It is also very useful to have the means of cooling your beer down to a certain temperature, as soon as it has discharged its yeast, so as that it may be immediately bunged down. Many are of a different opinion, alleging that this flattens the beer, but a handful of ground

rice thrown into each cask with a few hops, will soon remedy that. Frequent brewings also are absolutely necessary, to ensure a constant supply of good fresh yeast. It may be said we can get a change of good fresh yeast at any time from another brew-house. True, but are you sure that this change will answer your purpose? Should the other brewer be languid or out of trim in his fermentations so will you; unless you can by proper means make the yeast what it ought to be. I have worked in a large establishment from year's end to year's end, without ever having the least occasion for a change of yeast; and could do so again at any time; and my fermentations shall be as healthy and vigorous as any one's.

The greatest possible attention to cleanliness is also indispensable. Nothing should be left in pumps or mains to stand over from one brewing to another. The cleansing casks should be washed after every brewing. In short, the most minute attention to cleanliness should be observed, even to what may be considered mere trifles.

I do not approve of too much lime, that is to say, of constantly mixing lime with the liquor on the coolers. I think it penetrates too much into the pores of the wood, and sometimes imparts a disagreeable flavour to the beer; a little pounded charcoal occasionally mixed with the liquor would do better.

OF FINING BEER.

THE most efficient fining for beer we have as yet discovered, is isinglass. The best is prepared from the stomach of the sturgeon: it is, however, in this country, prepared from the stomach of the cod fish or ling; or, indeed, from that of any other fish, and also from the skins of soles, &c. Chemists state, that gelatine is dissolved by liquid alkalies. The common mode, however, of preparing it for beer fining, is by first dissolving the isinglass with vinegar, or old stale beer; it is then reduced with thin mild beer, generally brewed for the purpose, in all large establishments, from a raw or return wort. It must next be passed through a fine hair sieve, by means of rubbing it down with a hard hair brush and brought to its proper consistency with thin mild beer; and if properly made, it will have a clear transparent appear-

ance, without any of the fecula floating about in it.

Many are very much opposed to the use of fining, as they say it flattens and impoverishes the beer; I am of opinion, that it does neither, to any perceptible extent. It removes any extraneous matter that may be floating about in the beer, and changes the beer from bright to brilliant; I would therefore use it on all occasions, even to *bright* beer. The brighter the beer, the less fining will be necessary, and even half a pint to a barrel will sometimes make it brilliant. The common quantity used, is from a pint to a quart, or more, per barrel, according to the nature of the beer. Before using fining, however, it should be ascertained whether the beer is in a fit state for fining.

This is done by taking a sample of the beer, and putting it into a long glass vessel, made for the purpose; to this add a tea-spoonful or more of your fining; then give the mixture a good shake, by turning it up and down with both hands, the palm of one being placed on the mouth of the vessel. If the beer has been well brewed, its aptitude to become bright will be soon shown, by the mixture getting thick and curdy; a bright portion will generally make its appearance at the bottom or middle, and the

finings will at last mount up gradually to the top, taking all impurities along with them, and leaving the remainder brilliant. It has been stated, that the finings should have a contrary effect, and at once carry the impurities from the top to the bottom: I never, however, saw this take place, but with stubborn beer, which would not become thoroughly bright with any quantity of finings which could be added to it. Fining or finings usually have a specific gravity of 1·010 to 1·016, and when added to beer in a fit condition for fining, invariably go to the top, and not to the bottom. Let any one fine down a butt or barrel of beer, leaving the same quite full, with the bung out: should the finings not make their appearance at top, he may rest assured, that his beer will not be thoroughly bright: this can easily be ascertained, at any time. Should the sample fined down in the glass above mentioned, get bright, there cannot be the least doubt of the bulk doing the same. But if not, there can be no use in applying finings, as they will only do harm. The better the isinglass, the more finings can be made from the same quantity. Some people, I have heard, are in the practice of dissolving isinglass in boiling water, to make finings: this must be not only a very expensive, but a very erroneous mode of proceeding, as the finings, when thus

made, will immediately coagulate upon being applied to the beer, and at once go to the bottom, without producing the effect required.

It may be observed, that hot water, warm beer, or even steam, applied to *coarse inferior isinglass*, does not hasten the solution, but, on the contrary, hardens it, converting it into an *insoluble* fibrinous mass, from which very little fining can be obtained.

OF STORING AND KEEPING BEER.

THE circumstance mentioned in my preliminary observations, of part of the same gyle of beer keeping sound, when stowed in one way, while a portion stowed in another way got stale, shows that the storing and keeping of beer are points of no little importance. We always find that when beer is very much exposed to the action of some sort of electricity it is destroyed; whether it might be again restored by another action of electricity, I have not as yet had it in my power to determine. I should, however, think this to be a point well worth the attention and research of scientific men. We also know that when beer has been very much exposed to the action of the atmosphere, it becomes acid, by imbibing oxygen. This effect, however, is immediately produced by electricity, but only gradually by oxygen. But electrical action is one thing, chemical action another; and of the former kind of action, it is

admitted by chemists that we know but little,—we can only judge of it by its effects; and therefore any theoretical views in this place would be altogether irrelevant. I leave this part of the subject to philosophers, and only speak practically. There is, however, no doubt that electricity is the prime agent in every operation of nature.

From what has been said, it will appear that I am decidedly against any exposure of beer, either to the action of electricity or oxygen. Beer, therefore, immediately after having thrown off its yeast, should be racked, and closely shut up in as insulated a situation as possible. A valve, however, should be put in the top of all large vats or reservoirs, to permit the escape of the excess of carbonic acid gas, produced by the slow insensible fermentation going on in the vat.

This valve should have a considerable weight, so as to preclude a greater escape of gas than is absolutely necessary for preventing the bursting of the vat. All smaller casks, such as butts, hogsheads, barrels &c., should be placed on wooden bearers in as cool a place as possible, so that no part of the cask may touch either the floor or the walls. A wooden peg or spile should be put into the top of each, so as to give the beer a little vent when necessary, which it may

require every day for the first ten or twelve days; after giving vent, however, the spile should be immediately replaced. Should the beer have been originally well brewed, but little attention will afterwards be requisite. Beer will likewise always keep better when racked off with a little of its own dreg, than when it approaches to fineness. This may proceed from a portion of the *fecula* from the hops still remaining in the beer, which as it preserves the worts in the coolers, may also preserve the beer when fermented.

It is a well known fact, that should beer be fined down and racked before being sent out to the India market, it never turns out so well as when it retains a portion of its own dregs. That being the case, it is equally certain, that the same beer when kept in this country, must be equally benefited by an adherence to the same practice. If a vat of well brewed beer should be opened by taking off the lid or top, in the middle of summer, precisely the same appearance will take place as when a bottle of beer is uncorked, namely, the carbonic acid gas, will almost immediately make its appearance on the top of the vat, in the shape of froth, as it does from the neck of the bottle in brisk beer.

This might frighten a young or an inexperienced brewer, but to an experienced one, it is a certain indication that every thing is right. This

froth will soon subside: the lid should then be immediately replaced. I would also recommend, that the top of every vat for storing beer, should be covered to the depth of some inches with sand, over which a quantity of common salt should be sprinkled, and the whole moistened with water: this mixture when it begins to get dry should be again sprinkled with liquor or water. You thus always keep cool the top of the vat, and of course the beer contained in it, on the well-known principle, that liquids get denser or lighter according to their temperatures.

OF DRUGS.

ALTHOUGH, generally speaking, I object to every kind of drug in brewing, it would be folly to suppose, that we can at all times dispense with them. When every thing is going on well, no drug is necessary; but when *sickly*, a chemical remedy must be applied, and it is only then a brewer has it in his power to show his skill, by using proper remedies. He must, therefore, have some knowledge of chemistry, so as not to make use of any thing which may be hurtful, or perhaps cause combinations, which might turn out to be poisonous. We all know that sugar, by a very simple chemical process, is converted into oxalic acid,—a deadly poison; so that a brewer, having no knowledge of chemistry, might, from ignorance, convert the saccharine of his worts into poison; or, by improper combinations, make his beer very deleterious.

No man, therefore, without some knowledge of chemistry, is justified in trying experiments with an article of general consumption. The law, as it at present stands, forbids the use of chemical remedies; but I should suppose, that its object is merely intended to prevent the use of deleterious ingredients, or substitutes for malt and hops.

There is no law in France to prevent the flavouring of wines in any way the manufacturer may think proper, and there are very few French wines, which are not in some degree artificially flavoured. When *harmless* ingredients, therefore, are employed for this purpose, I can see no objection to their being used; and if the law of this country did not forbid their use, I believe the introduction of more deleterious ingredients would soon be discontinued. How many travellers do we see traversing the country in all directions, for the purpose of selling drugs to brewers, and that, in such quantities, as to make something like an apothecary's shop of a man's stomach. One drug is for the purpose of making the beer keep, a very desirable object; another for giving flavour; another to produce vinosity, &c. &c.: and the ignorant brewer is always induced to try them, by being told by these itinerant gentlemen, that such and such

eminent brewers always use them, and cannot do without them; although, perhaps, those eminent brewers have never seen or heard of such ingredients.

Other brewers in the country are anxious to impart what is called the London porter flavour, and are told that it is impossible to do so, without the use of these noxious drugs. I firmly believe, however, that no house of *any* respectability in London, makes use of any other ingredient than those authorised by law, and yet the different flavours of the respective houses, proceeding from their various modes of working, are easily distinguished by a good judge.

Any brewer, therefore, using such drugs, without knowing their component parts, may absolutely, although very innocently, be making chemical combinations, which will convert his beer into slow poison. Quite as good beer may be brewed from malt and hops alone, as can be produced with the assistance of any other ingredients whatever. But when we hear people say, "why cannot you give us beer of the same flavour as such another beer?" I reply, 'that the law will not permit it; such beer is flavoured with ginger, coriander seed, iris (*orrice*) root, &c. &c., all harmless ingredients, but prohibited by law." This law, as already stated, was made

I believe for no other purpose, than the prevention of the use of deleterious ingredients, or substitutes for malt and hops. Were it altered, however, so as to permit the use of harmless flavouring ingredients, not one half the quantity of deleterious drugs would be consumed, which are now resorted to by ignorant brewers.

Why should the brewer in England be prevented from giving to his ale a *bouquet* after the manner that the French give a *bouquet* to their wines? I am surprised that this is not more practised in private brewing, where there is no such restriction; for instance, a pine apple, raspberry or strawberry flavour, given to ale, would be very pleasant, and impart to it a *bouquet*, similar to the French champagne.

There is also a substance which was sometime ago in almost general use in porter, viz., sulphate of iron or salt of steel. The law, however, has imposed severe penalties on the use of it, and a test is applied for detecting its presence. The sulphate of iron is called in the trade, heading, and gives to the beer a fine frothy top, which adheres to the pot or glass from which the beer may be drunk. It also imparts to the beer a sharpness of taste, generally much liked by porter drinkers. This heading, when applied in small quantities, little more than a quarter of an ounce per barrel being necessary

to produce the effect wanted, is not, in the opinion of medical men, deleterious, excepting to those of plethoric habits who do not generally drink beer; on the contrary, it is deemed to be a good tonic, and in foul beer would make it more wholesome than it would otherwise be. It is certainly not a substitute for either malt or hops, and as people in general prefer porter which carries a good head for a long time, there can be no good reason why it should be so very severely prohibited by law. A substance is, I understand, made and sold by a chemist in London resembling capillaire, of which he sells considerable quantities. I am told that about one quart of this, when put into a barrel of thirty-six shillings beer, gives it a fulness equal to that at forty-eight shillings, and thus those that like very sweet beer are imposed upon. This, therefore, is certainly a substitute for malt, and should be looked after accordingly.

OF CHARCOAL.

THIS article although as yet little known in the brewery may sometimes be found very useful. Where the liquor or water for brewing is taken from stagnant pools, or from running water exposed to the falling in of leaves or other impurities, it may sometimes acquire a little putridity; in which case it will materially affect the quality of the beer, causing also putridity in it. It is well known that charcoal has a great tendency to remove all putridity; a small quantity of it, therefore, when used in the boiling of your mashing liquors, will in a great measure prevent the evil which might otherwise arise from such impurities. I have sometimes found it very beneficial, and used it thus:—A fine net bag was procured, into which was put a quantity of charcoal broken into very small pieces. This bag was suspended in the copper by means of a string, and the liquor made to boil. I had the means afterwards of soon

bringing it to its proper temperature without cooling down, and then proceeded in the same way with my other liquors.

I had previously to this sometimes been plagued with a kind of putrescency in my beer, for which, for a long time, I could not account, and at last conjectured that it might proceed from impurities in the liquor. After adopting the charcoal, however, I had none of it. I consider it a very useful discovery, which is now given to the public without any *more valuable consideration* than the price of this book. I have no doubt, that powdered charcoal might also be used very beneficially in the brewery in removing impurities from many of the utensils. Muriatic acid gas, evolved from a mixture of common salt and sulphuric acid, is also very powerful in removing mustiness or putridity from vats or other large utensils. Or still better is the use of *chloride* of *lime*, or bleaching powder; but the utensils must afterwards be filled up with liquor before being used for beer, to dislodge the acid from the pores of the wood.*

* I have since read that lime put into the net in pieces, along with the charcoal in boiling, is a great assistant in removing putrescency from liquor or water.

OF ROPINESS.

THE causes of this evil I have never been able to trace altogether to my own satisfaction. But it may be stated, that brewing from a mixture of unmalted corn, or what is much the same, from steely or half made malt, will produce ropiness in beer. It will also occur from an injudicious mixture of unsound stale beer with mild beer. This shows the necessity of having good malt. I have heard master-brewers, who ought to have known better, assert, that if they could purchase malt at a certain low figure, it made little difference whether it was good or bad, as a few quarters additional in a large brewing would make up the difference in gravity. They did not, however, take into consideration the risk they ran in having ill flavoured, and ropy beer. I will also maintain that beer brewed from the best quality of malt, although ten per cent. weaker, shall at all times taste five per cent.

fuller and better than beer brewed from ill made malt.

The odour, for instance, of a distiller's fermentation, who works from a mixture of raw corn and malt, is always as different as night from day, from that of a brewer's, who has a sound fermentation, and works with good malt. The first has always a fœtid odour, while that of the other is highly vinous, pungent and aromatic. I have already said, that the nose is almost a sure guide to an experienced brewer, in ascertaining whether his fermentation is going on well or ill. But I would wish to impress this point more particularly on the mind, than I have perhaps formerly done. An experienced brewer with a very sensitive smell, should be able to judge even by walking through a brew-house, whether or not it is in trim, and I again repeat that no man who has not both a very sensitive smell and taste, can be a good brewer. Many I know will say that this is a fanciful idea. But how often do we see that even one man, who is acknowledged to have a good taste for wine or beer, will guide the opinions of a large majority in any company, as to the good or bad qualities of the beverage they are then drinking. The majority, perhaps, are not the best judges; indeed I have seen men so devoid of both taste and smell, that it made

very little difference, whether putrid or fresh food were presented to them. I think it was King George the Second, who had been so much accustomed to stale oysters in Germany, that he could not relish the fine *natives* of England.

Many remedies for ropiness have been proposed, but I believe the best is, to put the beer into a vat with a false bottom, and add four or five pounds per barrel of hops, taken gradually away after the first boilings of the worts, to which may be added about half a pound per barrel of mustard seed. Rouse the beer well as you keep adding the hops, and in some months the ropiness will be pretty nearly cured. The beer should be drawn off from below the false bottom.

OF MARRYING OR MIXING BEERS.

A GREAT deal of harm is often done in the brewery, by an injudicious mixture of new and old beers. I have known this carried so far, as not to leave the brewer sufficient room to work in; in other words, he is said to be blocked up. Mild beer is now become the order of the day, and old beer, except when mixed with new, is seldom drunk. The only way, therefore, in which a brewer can get rid of his returns or old beer, is by a mixture with new and mild beer. This is sometimes done by breaking it gradually into his squares with the worts while in a state of fermentation. I consider this, however, to be a very dangerous mode of working; for should his fermentation be in the least languid, the whole gyle or brewing will become unsound in a very short time after being cleansed; thus adding considerably to his stock instead of diminishing it. Others break in their old beer in the breaking batch, before the beer is

pumped away to the vats. This will be also attended with bad effect, unless the fermentation of the beer has been very vigorous and healthy; and equally so, should the old beer not be in a fit state for mixing at the time. It requires an experienced brewer or storehouseman to put the old beer in a fit state for marrying, and the mode of doing it so much depends on the state the old beer may be in at the time, that no definite rules can be laid down on the subject. I should, therefore, recommend to any brewer, should he have a stock of old beer, that before trying to mix it, he consult some one well acquainted with the different modes of treating it, so as to bring it round to a fit state for being worked off in that way. I have known brewers who have been at last so blocked up for want of room by injudicious management in this way, that they have been obliged to turn a considerable quantity of beer down the kennel; and perhaps, this is often the best way to get rid of it.

OF GREYNESS IN BEER.

I HAVE never as yet been able to ascertain with certainty, from what cause greyness generally proceeds. My opinion, however, is, that it often arises from too long boiling of the last worts. It may also be occasioned by the use of bad malt or hops, or by various other causes. I have never been able to find out any certain cure for it.

Formerly *grey* beer was much more common than of late years; a frequent cause of this defect arose from the imperfect manner the fermentation was then conducted, assisted by the necessity the brewers were then placed in, of moving the *cleansing-casks* in starting the beer. The introduction of *rounds* or fixed casks, for cleansing, when properly placed, has been a great improvement.

Should you have a vat with a false bottom, the same as the mash tun or jack back: you may run grey beer in there, and throw into it four or six pounds per barrel of spent hops, immediately after taking them from the jack back, this after standing some time will partially take off

the greyness. Grey beer may sometimes appear pretty bright when viewed by transmitted light; but when viewed by reflected light, it has always a colour like whey. Clean beer, when viewed downwards in a pot, has always a fine black face, as it is called. Grey beer will always appear whey coloured when seen in the same manner. If, therefore, we have not good malt or hops to work from at all times, there is always danger to be apprehended in some way or other.

Whenever a brewer is unsuccessful in his operations, we generally hear him say that it is entirely owing to working with bad materials. He thus throws the blame, sometimes very wrongfully, on the maltster and hop merchant, when he himself cannot tell what may be the cause of his want of success.

Although I admit that the brewery is very much indebted to Mr. Richardson, for the introduction of the saccharometer, and for the mode of making the lengths, I do not agree with him in some of his directions as to brewing and fermenting. His directions as to temperature for mashing are certainly not precise enough, or such as to be a sure guide to any one.

In his method of fermentation, he says, "at 75° the first flavour of mild ale commences; for under that it is more properly the flavour of ale intended to be improved by long keeping.

At 80° the flavour of ale is more perfect; at 85° it approaches the high flavour; at 90° it may be termed high, but is sometimes carried to 100° or upwards, the flavour increasing in proportion to the heat of the fermentation." In all these points I differ from Mr. R. in toto. I say that the best flavours are acquired at vinous temperatures, which should never exceed 75°; and I therefore maintain that the first heat when all the worts are in the square should always be such, as that the last heat shall never exceed 75°. I have already given a range of from 50° to 75°, as quite sufficient for the acquirement of any flavour that may be wanted if your fermentations are sufficiently vigorous. This, however, Mr. Richardson says, entirely depends upon the yeast, which can only be remedied by a change of it from another brew-house. In this also I differ from him, and contend that an experienced brewer ought always to know how to make a change of yeast for himself, so as not to be dependent upon other brew-houses, from which the change might prove as bad as his own.

If Mr. Richardson's rules for cleansing were strictly adhered to, the whole of the beer in my judgment would be yeast-bitten to a greater or less degree. Whenever a fermentation begins to flag, there is danger to be apprehended in some way or other, either from

the action of electricity, unsoundness in the wort, or from bad yeast. An experienced brewer should always be able to know from which of those causes it does proceed, and to act accordingly.

Mr. R. recommends that the fermentation should come to a stand still before cleansing. I maintain, on the contrary, that the fermentation should be in a most vigorous state at cleansing time, and that the smell of the gas should be more pungent and powerful than in any other stage of the process. Should this not be the case, your beer is sure to be either mawkish or partially yeast-bitten. I quite agree with Mr. R. however, in the opinion, that an inspection of the fermentation is necessary every two or three hours, when it is going on languidly, in order that proper remedies may be applied; and I also agree with him, that a pint of hops, after the first boiling, put into a barrel of beer, is of service both as to brightness and keeping.

Why should Mr. R. in his mode of fermentation for porter limit his highest fermenting temperature to 70° or little more, when in ale he allows it to go as high as 100°? In porter I would be inclined to give a greater latitude in temperature than in ale, as the mixture of brown malt is not so apt to fly off to an acid, as pale malt alone.

OF THE FLAVOUR OF THE LONDON PORTER.

LONDON has always been celebrated for the particular flavour of the porter brewed there; but as there are almost as many different flavours as there are houses, it becomes, in my opinion, difficult to say, which is the LONDON flavour. These different flavours however are produced by their different grists and modes of working, and not from artificial flavours which are generally supposed to be given.

Those frequenting the public houses served by any one of the great brewing establishments, get accustomed to the particular flavour of such beer, and of course prefer it to any other; and a great name often gives a celebrity which the beer does not at all times deserve. The London porter, however, has lately been rivalled, it is said, in the public estimation by Dublin stout, whether deservedly or not, I shall not pretend to say; but I have lately seen, a great deal of what was said

to be Dublin stout, quite ropy, which is no great proof of its good qualities. The London porter, generally speaking, it is said, does not now preserve the same soundness as it did in the recollection of some of its oldest drinkers. Should this really be the case, I have no doubt that it proceeds from some bad arrangement of the plant, so as to admit the action of electricity, or from the introduction of steam in some of the departments. Many are of opinion that, what is called the London flavour cannot be acquired but by brewing on a large scale. The opinion seems unfounded from the fact, that as good porter and stout can be brewed in a five-quarter mash-tun as any brewed in London on a large scale; and if this can be done in London with spring water, I do not see any reason why the same may not be done in any part of the country with equally good materials.—If stout and porter can be brewed in Dublin, which is said to rival that brewed in London, what should prevent the same being done in any other, the smallest town in either country ?

No single house can imitate the different flavour of all the great London establishments; but the flavour of any particular house can be easily acquired. By the way, talking of flavours, I must take the liberty of relating an anecdote which is said to have occurred during the

last century. A Dutch house was at that time in the practice of getting whole gyles of porter brewed on purpose for them by one of the great houses in London. On one occasion one of their clerks was in London at the time of brewing, and went to see the process. He unfortunately, poor fellow! tumbled into a copper of boiling worts, and before he could be got out again was actually boiled to death. There were no dome coppers in those days. The gyle of beer was sent over to Holland, and turned out to be very good. The next batch sent, however, did not turn out so well, and the Dutch house complained of it, saying, it had not the same flavour as the preceding gyle. The answer returned by the London house was, that they had no means of giving them precisely the same flavour, unless they would send them over another Dutchman. So much for flavour.

OF SOUND OLD BEER.

SUCH an article as prime sound old beer is now but rarely met with, excepting sometimes in noblemen or gentlemen's families, where the beer is home-brewed. I have already stated that the butler has generally as much, or more, to do with the preservation of home-brewed beer than the brewer.

The beer is originally brewed very strong, and given over by the brewer in a state of unattenuated wort to the butler. There is then so much saccharine left in the beer as to prevent the approach of the acetous fermentation, unless it be exposed to high temperatures and the action of the atmosphere.

A second fermentation, however, is absolutely necessary before it can be called beer; and according to the management of the butler, it becomes good or bad. The preservative qualities of the best home-brewed beer, therefore, proceed entirely from its great strength, and not from any superior knowledge possessed by the

brewer. The weaker beers are always drunk when new before they have time to get acid.

In the public brewery however the case is different: such strong beer as that brewed in private families is never wanted, and the beer is much more attenuated during the process of fermentation. During, or even before this process, however, the acetous principle is frequently communicated without the brewer being at all aware of it; and in a very few weeks or months the beer gets pricked. This, as I have already stated, proceeds from the action of electricity or other causes. Magnificent works have been erected by first-rate architects for brewing; but from their want of knowledge of the action of electricity upon worts and beer in all its stages, these works are so constructed as to prevent the possibility of brewing really sound beer but at certain times. Such is the obstinacy of some people, that, were any scientific man to offer to them his advice upon the subject, he would only be laughed at, and scornfully asked if he thought *they* wanted any information on the subject? Until this information, however, be given and taken, the art of brewing, instead of progressing as other sciences have done, will still retrograde, as it has been said to have done for many years, until at last, during summer, there will be no possibility of producing a supply of really sound beer.

Having lately had occasion to give some instructions in a small brewhouse in the neighbourhood of London, immediately on going into the work, I objected to the arrangement of some part of the plant, but said I would try one brewing. I did so, and found that I could do no good. I at once stated to the proprietors, that I would not attempt another gyle unless they would allow me to make an alteration; to which they at once very handsomely agreed. The result has shown them that I was quite right, and they think I have done them an essential service. I have authority to mention their names to any one who may wish any further information on the subject. The mischief happened from a galvanic action giving acidity to the beer during the fermentation. I have the authority of a scientific gentleman to whom I was lately introduced to say, that he can at any time immediately communicate to the soundest beer the acetous principle, by sending through it a shock of electricity.

This being the case, is it not possible, that a slight galvanic action may take place in the earlier stages of the process from causes already mentioned, imparting an unsoundness to the worts, which cannot afterwards be got rid of? I do not say that this does always actually happen. I merely throw it out as a hint, to prevent the use of too many metals in the construction of any of the utensils.

PRACTICAL BREWING.

I NOW proceed to practical brewing. I must, however, in the first place, make a few additional remarks on the construction of the brew-house and other matters.

Wherever I have found the brew-house constructed in the manner I have before recommended, I never experienced the slightest difficulty in managing the fermentations as I pleased, when working with good materials. In others differently constructed, however, I was always obliged to force the fermentations, and often in such a way as to incur the risk of getting yeast-bitten. This has quite confirmed me in the opinion that electricity is a powerful agent in fermentation. Wherever I have found the utensils placed in insulated situations, I have found no difficulty in fermenting. But wherever the squares or gyle tuns have been imbedded in the ground, or connected with it by means of metal pipes, my fermentations have been very precarious

and uncertain. So much so that I would never again attempt to work in a brew-house so constructed. This, being a new doctrine, may perhaps be laughed at by many who reckon themselves very successful brewers. But while I am supported in my opinion by such authority as that of Sir H. Davy, and many other gentlemen of undoubted scientific knowledge, in chemistry and philosophy, both at home and abroad, I shall at all events be laughed at in good company. And if it be afterwards discovered that this new doctrine should be the means of generally improving the beer throughout the country, I may perhaps be allowed to laugh in my turn. I have no hesitation in saying that I could, if necessary, bring forward a host of evidence to prove the action of electricity on fermentation, as also on destroying beer, but as I have no wish to swell out this treatise to a book-making size, I shall content myself with the two instances already mentioned under the head of electricity.

The great desideratum in my opinion is to produce a clean well-flavoured wholesome beer, such as will not hurt the stomach more than the best wines. To that, therefore, I shall confine myself. A very able treatise on brewing has lately been published by Mr. David Booth, under the superintendence of the Society for

the Diffusion of Useful Knowledge. In Parts III. and IV., he gives a very accurate account of the different modes of brewing beer on all parts of the continent. From long habit the consumers get accustomed to the different palates of their own beers, but I doubt very much whether even the best of them would suit the English taste.

I shall, therefore, confine myself to the results of my own practical experience. The late Mr. Richardson of Hull, had the honour and merit of first causing the art of brewing to be regarded as a science in this country, by the invention of the saccharometer, and no man could possibly carry his researches farther than he did, as to the most scientific mode of making the extracts. But I must differ from him a little as to the intoxicating qualities of beer of different gravities. I think, that when worts of 40lbs. gravity have only been attenuated 18·4 lbs. and when worts of 24·3 lbs. gravity have been attenuated 18 lbs. the inebriating effect, if drank immediately, would be pretty nearly the same. But if both are allowed to stand over six or twelve months it will be found, that the worts of 40 lbs. which had only originally been attenuated 18·4 lbs. will then be attenuated perhaps 12 or 14 lbs. more, by what is called the insensible fermentation during that period, while

the other will remain pretty nearly the same. This, therefore, will account for the difference of the inebriating effect of the beer brewed from the worts of the greater original gravity.

Perhaps, also, his distillations might have been made from new mild beer, which would account for the little difference of the quantity of spirit produced from each: were this not the case, how could we account for the difference of the quantity of spirit produced from distillers' wash, according to the extent to which the fermentation has been conducted. Mr. Richardson was certainly a gentleman of great practical science, and I may perhaps be wrong in my conclusions, but I cannot at present find any other mode of accounting for the little difference which he made in the quantity of spirit extracted, or for the difference in the inebriating effects of the two, unless both were older when drank.

As the saccharometer had been then only newly introduced, perhaps he might not have thought of ascertaining the difference of attenuation made by the insensible fermentation. It is, therefore, absolutely necessary in making experiments of this kind, that the different fermented liquors to be tried should be of the same age.

OF THE SACCHAROMETER.

I HAVE already stated that Mr. Richardson was the first inventor of this instrument for trying the density of worts, and for which the trade in general is very much indebted to him. Before his time, rude instruments had been constructed by different brewers for the purpose of, in some measure, ascertaining the value of the malt. Equal quantities, for instance, of wort and water were weighed against each other, but this mode was found to be troublesome, and was only practised by very few. Since his time various other instruments have been introduced for the same purpose; but for real utility, I do not think that his instrument has been excelled by any, and from its having only one pound gravity on the stem, fewer mistakes can possibly occur than where you have 10 or 20lbs. in the same space. Mr. Dicas of Liverpool introduced an instrument for trying the specific gravity, and his scale is nearly as 5 to 2 of Mr.

Richardson's, or 80lbs. by Richardson's is 200 by Dicas's. This instrument, however, being more complicated, with an immense number of weights, is not now much in use, and the more simple one is quite accurate enough for the trade. Allan's saccharometer is generally used by the brewers and distillers in Scotland, and is very accurate; it indicates the true specific gravity. It was invented by Professor Thomson of Glasgow. Various other saccharometers are used by brewers throughout the country; but that of Mr. Joseph Long, of Tower Street (London), is to be preferred. This instrument goes as high as 51 to 52lbs. per barrel, gravity, with only one weight; to which he has added a thermometer, with a condensation table on the scale, thus saving a great deal of trouble. However, the indications of any saccharometer or hydrometer, if accurate, may be easily compared and reduced to any scale, by recollecting that the saccharometer indicating lbs. per barrel is founded on the fact, that a barrel of water at 62° weighs 360lbs., while the saccharometer of Allan, or Bate, indicating degrees of specific gravity has 1000· or 1·000 for its unit. Dividing 1000 by 360 we obtain the factor 2·78. The rule, therefore, in comparing the indications of instruments indicating special gravity to lbs. per barrel, is simply to divide the gravity shown by 2·78,

and the result is the lbs. per barrel by Long's saccharometer; or, to convert Long's gravity to the specific gravity of Allan or Bate, multiply by 2·78. Mr. Long's may in my opinion always be depended upon. A drawing and description of Long's instrument will be found at the end of this book.

In the following processes, in noting the weight of yeast used in the different fermentations, will be found letters characteristic of its qualities. S. S. means solid stillion, or yeast which has been kept in the stillion for some days, until it has become thick or solid. L. S. means light stillion yeast, or what has been immediately or lately thrown off from the beer. M. S. S. signifies middling solid stillion, or what has been thrown off the beer the day before. S. L. S. indicates strong light stillion yeast approaching to S. S.

Having already, under the head Yeast, given directions, as to what I consider the best modes of preserving it for use, I would again beg leave to impress strongly on the minds of all brewers, the importance of attending to those directions. Yeast which has been long lying about fretting and expending its strength, will never produce beer of equal vinosity and flavour, with that which has been at once taken out of

the stillions before it has had time either to fret or get stale.

Nothing perhaps can more strongly exemplify this, than the difference of the aromas between a distiller's and a brewer's fermenting backs in a state of vigorous fermentation. In a brewer's tun, if every thing be going on right, the smell, although pungent, will always be found to be highly aromatic and vinous. In all distillers' tuns, at least in all I have had an opportunity of seeing, the gas, although quite as pungent, is totally different, having always a sickly, and to me a fœtid and disagreeable smell; whether or not this difference in smell may be advantageous to the distiller, I cannot say,—I should think not.

As some of the technical terms used may not be thoroughly understood in all parts of the country, I shall endeavour to explain them.

Set or *Setting* tap means opening the cocks to drain off the worts from the mash tun.

The term *pitched* or *pitching* at the commencement of the fermentations, signifies letting a small portion of the worts into the fermenting vessel or gyle tun, at a higher temperature, with a certain quantity of yeast; so that the process of fermentation may be fairly commenced before the cooler worts are mixed with them.

Creaming over means the first of the five stages or changes in a regular fermentation, when the tops of the worts appear as if covered with fine rich cream.

A *Curling* or *Cauliflour* top indicates the second stage of a regular fermentation, when the appearance all over the tun is like heads of fine cauliflour. By the vigour or weakness of this curl we may almost to a certainty judge of the after success of the fermentation.

A *light yeasty head* indicates the third stage of the process, when the curl has entirely disappeared, and is succeeded by a fine rocky or alpine appearance all over the tun, which gradually gets to nearly a level.

Head *falling* or *dropping* means the dropping or falling of this head, which always happens in a good fermentation after a certain time, denoting the fourth stage or change.

A close *yeasty* head shows the fifth or last change of the regular process of fermentation, when the head again rises, but with quite a different appearance to the former, as it should now have an yeasty appearance all over, with many little transparent air bells constantly appearing and bursting, with a discharge of carbonic acid gas.

Stomach means the pungency, but more particularly the odour of the vapour evolved

during fermentation; by which an experienced brewer should at all times be able to judge how the process is going on. I therefore repeat, that an accurate smell is invaluable to a brewer, and as I have before said, a good taste is not less advantageous, since the union of the two furnishes a ready means of detecting errors, which might otherwise escape observation. I am not aware of any accurate chemical tests which can at all act as a substitute for these senses.

I recollect having been on a certain occasion asked by an eminent brewer to give my opinion of the comparative merits, of two different gyles of beer, then in the cleansing rounds. Judging from smell and taste, I decided in favour of the weaker beer as being the cleaner of the two. I was told, however, that I was quite wrong, because the other was stout. My opinion had not been asked as to strength, but if it had been, I should still have adhered to the opinion that the weaker, being the cleaner beer, was the better beer of the two.

I have used the term *bladdery* to denote large bells or blisters resembling blown-up bladders all over the top of the tun. These are sometimes transparent, and sometimes opaque or whey-coloured; when transparent, a supply of good light stillion yeast with proper treatment may remove them. When opaque, the evil generally proceeds

from unsound worts, and cannot be thoroughly cured, at least by any means I have yet discovered.

I shall now proceed to give a few processes for brewing different sorts of beer, as practised by myself in a small brew-house in London, not many years ago. In these processes, the fermentations will all be found to have gone on well and regularly; and the beer was in general very highly approved of, and could have borne a comparison with any other beer at the same prices.

The brewings indeed were only on a small scale; but the same process for making the extracts may be adopted on any scale; by making the necessary calculations.

Less yeast in proportion will be required on a larger scale; but, as has already been stated under the head of fermentation, no definite rules can be laid down, as to the precise quantities which may be necessary, as they vary according to circumstances.

As I used Dicas's instrument, I have given his specfic gravities. They are nearly as 5 to 2 of Long's, as shown by one of his tables which accompanies his instrument.

BEST ALE.

No. I. THERMOMETER 36.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
Decr. 10th	Best Ale.		Chevaliers.	Goldings.	1	12		175°	6	109	654							
					2	5		192°	5	83	415							
Morn. 6.		7	Pale.	72			S. 3	200°	3	61	183	17½	14½	12	113	1356		
							3	160°	3	50	150							
							*12	150°		23·3		11				256		
		7		72		17	18							12		1612	113	230

Evening pitched with one barrel of wort at 65°, yeast 8lbs. S. S.—Evening 7, got all in square at 56°, yeast 30lbs. S. S. — 11th Morning 6, a fine strong curling top: heat 58°. — Evening 8, a fine rocky light yeasty head, and strong vinous stomach: heat 64°. — 12th Morning 6, a fine light yeasty head still holding up; stomach still strong and vinous: heat 70°, attenuated to 50lbs. — Morning 11, head beginning to drop: heat 72°. Turned on the refrigerator gently, and added 4lbs. of yeast, fine L. S. — Evening 7, a fine close yeasty head, and very strong healthy and vigorous stomach: heat 73°, attenuated to 35lbs. cleansed; attenuated in casks to 25lbs. This ale was pronounced by all who drank it, to be as good as any they had ever tasted, price 4*l.* 4*s.* per barrel.

* Raw Wort to next Brewing.

XXX — 68*s.* PER BARREL.

No. II. THERMOMETER 40.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for peice or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
	XXX Ale at 68s.		Chevaliers.	E. Kent.	1	12		175°	6	95	570							
					2	6		190°	6	77	462							
Decr. 23d		7	Pale.	66			S. 3	180°	3	64	192	22	17	14½	92	1334		
							3	180	3	41	123							
Morn. 6.							3	165	3	31	93							
							*12	150		23		12				276		
		7		66		18	21									1610	92	230

Evening 7, pitched with one barrel of wort at 65°, yeast 8lbs. S. S. — Evening 8, got all in square at 57°, yeast 32lbs. S. S. — 24th Morning 6, all creamed over, and curl rising: heat 58°. — Evening 7, a fine light yeasty head, and strong vinous stomach: heat 62°. — 25th Morning 6, light yeasty head still rising, and all right: heat 69: turned on refrigerator gently. Morning 11, head dropping: heat 70°, attenuated to 40lbs., added 5lbs yeast, fine L. S. — Evening 5, a fine close yeasty head, and healthy vinous stomach, the gas rising through little transparent air bells: heat 72°, attenuated to 30lbs., cleansed; got down in casks to 23lbs. When sent out it was allowed by all who had it to be as good as any in London, at the same price, viz., 68*s.* per barrel.

* Raw Wort to next Brewing.

XX — 58*s.* PER BARREL.

No. 3. THERMOMETER 44.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
					1	12		175°	5½	97	533.5							
				E.K.				T. 146°										
Decr. 3	XX Ale.	6	Pale.	42	2	5½		200°	5½	80	440	20½	16	13½	88	1188	88	198
							S. 3	180°	3	62	186							
							3	160°	3	41	123							
							3	100°	3	30	90							

The fermentation of the above gyle was regular and good all through, the same as the two preceding,—got together at 56°, and cleansed within 50 hours: heat 72°, attenuated to 30lbs., got down in cleansing casks to 24lbs gravity.

X.—48s. PER BARREL.

No. 4. THERMOMETER 46°.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
					1	12		178°	6	91	546							
				E.K.				† 150°										
Decr. 8	X Ale.	6	Pale.	42	2	6		195°	6	64	384	21	17	14	77	1078		
							S. 4	180°	4	40	160						77	205.3
							5	150°	5	29	145							
							12*	150°	12	15						154		

All regular and right as before, same heats, and same attenuation, &c.

* Raw Wort.

† Heat of Wort running from Mash Tun.

TABLE ALE.—36s. PER BARREL.

No. 5. THERMOMETER 32°.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
							12*			18	196							
Decr. 27th	Table Ale			Sussex.	1	12		176°	8	87	696							
								†154°										
Morn. 6.		4	Pale.	21	2	6		190°	6	50	300	23	20	17	66	1122		231.5
							S.9	175°	9	25	225					196‡		
		4		2							1221					926		231.5

Evening 4, pitched as before; two barrels of wort at 70°, yeast 6lbs. S. S. — Evening 5½, got together at 57°, yeast 28lbs. S. S. in all 34lbs. — 28th Morning 6, a fine strong cauliflower-head; no heat gained. — Evening 6, a fine light and rocky yeasty head; stomach very vinous and healthy: heat 60°. — 29th Morning 6, head beginning to drop; fine stomach: heat 66°, attenuated to 35lbs., yeast 5lbs. L. S. — Morning 11, a fine close yeasty head: heat 69°, attenuated to 30lbs. gravity, cleansed; got down in casks to 20lbs.

* Raw Wort from last Brewing. † Heat of Wort, when running from Mash Tun. ‡ Off Raw Wort.

BROWN STOUT.

No. 6. THERMOMETER 48°.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
						12*				16	192							
		2	Amb.	E. K.	1	12		170°	6	92	552							
					2	6		190°	6	64	384							
Novr. 22.	Brown Stout.	2	Pale.	40			S. 3	170°	3	59	177	23	19	16	84	1344		
				Sussex.			S. 3	160°	3	48	144					†192		
		2	Blown.	40			S. 4	152°	4	32	128							
		$\frac{1}{8}$	Roasted															
		$6\frac{1}{8}$		80		18	12		22		1385					1152	84	192‡

Pitched at 63°, 2 barrels wort, yeast 6lbs. S. S.: got together at 60°, yeast 42lbs. S. S.—25th Morning 6, creamed over.—Evening 4, a fine light yeasty head.—Evening 9, light yeasty head still rising; stomach not strong.—26th, Morning 6, head dropping, strong healthy stomach: heat 72°, attenuated to 45°: yeast 7lbs. S. L. S.—Evening 3, a fine close yeasty head, and strong healthy and vinous stomach: heat 74½°, attenuated to 28°, cleansed; got down in casks to 20lbs. This beer turned out to be excellent.

* Raw Wort, from former Brewing. † Off Raw Wort. ‡ Roasted Malt not included.

PORTER.

No. 7. THERMOMETER 48°.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
						*12					150							
Novr. 29th	Porter.	1⅛	Amber.	New Sx.	1	12		170°	8	75	600							
		1½	Pale.	25				T. 144°				21	19	16	58	928	58	194·7
Morning 6.		1	Brown.	O. Kent	2	5		180°	5	45	225							
		⅓	Roasted	25	3		S. 7½	160°	7½	22	165					+150		
		4		50										16		778	58	194·7

Evening 6, got together at 60°, yeast 32lbs. S. S. — 30th, Morning 6, a fine curling top: heat 61°. — Evening 6, a fine light yeasty rocky-head, and strong vinous stomach: heat 64°. — 1st Dec. Morning 6, head dropping: heat 70°; stomach strong, attenuated to 12lbs., yeast 4lbs. L. S. — Evening 2, a fine close yeasty head, and strong vinous stomach: heat 74°, attenuated to 27lbs, cleansed; got down in cleansing casks to 15lbs.

* Barrels of Raw Wort from former Brewing. † Off Raw Wort.

IRREGULAR FERMENTATION.

THE following gyle of porter was brewed in premises I have already mentioned, where the gyle tuns and fermenting casks were so ill arranged, as to prevent the possibility of any certainty in the fermentations. A young friend who was then with me learning to brew, and who is now in London, will, I dare say, attest, that I often said to him, I was sorry I had never while there had it my power to show him a really regular and good fermentation. I was not then however so well aware of the cause as I now am. But had I been so, I should not have had it in my power to procure the necessary alterations. And had I mentioned my reasons for wishing them, I doubt if they would have been understood by the parties concerned. It will be seen by my notes on the process that the fermentation was very indifferent and irregular, and never had a fine close yeasty head at any time. I afterwards found that the best method I could

adopt was always to give a good quantity of yeast, and cleanse young, although this is a very uncertain mode of working. — Brewed with Richardson's instrument.

No. 8. THERMOMETER 50°.

Date and Time of Brewing.	Kinds of Beer Brewed.	Quarters of Malt.	Kinds of Malt.	lbs. of Hops.	Number of Mashings.	No. of Barrels turned on.	No. of Barrels for piece or sperging.	Heats.	Barrels of Wort in underback.	Gravities.	lbs. extract in Raw Wort.	Barrels of Wort in Copper.	Barrels out of Copper.	Barrels of Wort in Squares.	Gravities.	lbs. extract in Squares.	Average per Barrel.	Average per Quarter.
				Year's.														
Oct. 20		25	Pale	256	1	84		165°	45	35	1575							
				New.								102	97	70	30·4	2128		
Morn. 5	Porter.	9	Brown	188	2	48		175°	50	19	950						20·4	76·3
		½	Roasted		3	54		160°	56	9·6	537·6	109	100	74	11·0	814		
					4	44		159°	46	4·5						2942		
											207					*315		
		34½		444										144		2627		

Evening 1, pitched with 3 barrels wort, at 70°, and 24 lbs., yeast L. S. : — Evening 3, first worts down, at 62°, yeast 60lbs. S. S. — Evening 9, second worts down, altogether 61°, yeast 100lbs. L. S. and S. S. equal weights. — 21st, Morning 6, curling top, no heat gained. — Evening 8, a light yeasty head, but very little stomach : heat 64°. — 22nd, Morning 5, head just beginning to drop; a pungent, but not vinous stomach : heat 69°, attenuated to 12lbs. gravity ; yeast 60 lbs. L. S.—Noon 12, head again rising, but rather bladdery, and not properly yeasty : heat 71°.— Evening 4, head the same as before ; stomach pungent, but not vinous : heat 74°, attenuated to 9lbs. ; cleansed, to prevent getting yeast-bitten.

* Off Raw Wort for next gyle.

THE FRETTING OR FRETFUL FERMENTATION.

I SHALL here suppose, that we have 100 barrels of porter got together at 60°, with 150lbs. yeast.

Second morning, a curling top turning over in broad flakes, like the curls of a wig.

Evening 4, A light yeasty head, looking blueish; a faintish stomach; heat 63°.

Evening 9, Head beginning to drop; stomach still faintish, but pungent; heat 64°, attenuated to 16lbs. gravity; yeast 20lbs. L. S.

Third morning 6, Head all over large air bells or bladders only about two inches high, and a sort of undulatory motion of the beer all over the tun; heat 70°, attenuated to 11lbs. With a good regulator or refrigerator in the tun, and a good supply of lively, light, stillion yeast, this fretful fermentation may sometimes be made healthy, if it proceeds from the use of bad yeast; if, however, it arise from unsound-

ness in the wort, no after treatment can ever make it good beer, although it may be partially corrected.

Morning 11, Having no lively yeast to work with, and finding I gain neither in heat nor attenuation, the same bladdery head and undulatory motion still going on, I cleansed, to avoid getting yeast bitten. The beer was mawkish, but no fault was found with it. If the above mentioned bladders, or air bells, be quite clear and transparent, the bad fermentation generally proceeds from bad yeast; if opaque or whey-coloured, it is more likely to originate in unsoundness of the wort.

INERT FERMENTATION.

THE next process is the inert, or sluggish fermentation:—it is now, however, so long since I have permitted that process to go on, that I have not preserved notes of my extracts for the brewing. I shall, therefore, suppose we have 50 barrels of porter, at 21lbs. gravity by Long's or Richardson's instruments, and give my notes during the process of the fermentation.

25th October; Evening 1, pitched with three barrels first worts, at 70°, yeast 10lbs. L. S. — Evening 3, first worts down at 60°, yeast 30lbs, S. S. — Evening 9, got altogether at 60°, yeast 40lbs., S. S. and L. S., equal weights.

26th, Morning 6, the curl just beginning to rise, but with an indifferent appearance, turning over like the curls of a wig, in broad flakes.— Evening 6, a light yeasty head, with a blueish appearance: heat 62°, stomach faintish.

27th, Morning 6, head beginning to drop,

but still the same faintish, but pungent stomach: heat 68°; worts taste mawkish, attenuated to 12lbs. gravity, yeast 25lbs. L. S.—Morning 11, the head again rising, but not properly yeasty, and quite level all over, without a single bell, or small bladder: stomach or smell, very much like that of a distiller's tun, but not so strong or pungent. — Evening 6, head well risen, but not yeasty; the same level appearance all over without the bell: taste and smell still mawkish: heat 72°, attenuated to 8lbs. gravity; cleansed.

This beer worked apparently very well in casks, but with no proper yeasty appearance. It never lost its mawkish taste and faintish smell, and was destitute of the vinous quality.

It is sometimes difficult to get the attenuation in this fermentation below a certain point, unless you have or can procure a supply of good lively yeast.

THE BOILING FERMENTATION.

THIS very bad fermentation must also arise from some of the causes already referred to. It commences like others with a creamy top, but the curl rises very light and faint. The light yeasty head has generally a bluish appearance, and the stomach, although sometimes pungent, is never healthy or properly vinous. When the light yeasty head falls, no other rises, and in a short time the head subsides altogether, and the tun assumes the appearance of a state of ebullition. If allowed to go on in this way the beer is sure to get foul or yeast bitten. If there be a good refrigerator or regulator in the tun to cool it down a little, the best plan is to put it into immediate operation, and then *sprinkle* a little fine flour of malt all over the top of the beer.

If you have then a good supply of fine lively light stillion yeast, keep gradually adding a little until another head begins to rise. Old stale yeast will do more harm than good. It is more advisable, however, to avoid all those erroneous

fermentations by finding out their causes, which can always be done by any experienced brewer.

It may probably be supposed by some of my readers that I have expressed myself too confidently on many points upon which I have treated in these pages; but as all that has been advanced is the result of long experience, I shall be at all times ready to confirm *practically* any statements to those who may be pleased to do me the honour of consulting me.

When fermentations are going on regularly, there is no kind of trouble with any thing, and we have it in our power, to arrange so as to have all our *cleansings* in the early part of the day, instead of during the night, which is a great saving of labour to both masters and servants, besides the certainty of having all things better attended to. When, however, we observe the least irregularity in our fermentation, we should immediately endeavour to find out the cause, which must proceed from one or other of the reasons already mentioned in this book. In my general summary these causes will be set forth in a more condensed form, and it is only further necessary to add the old adage, "one stitch in time saves nine."

I have given no instruction for brewing pale beer for the India market; but the documents from Calcutta quoted in this book, will show that I am acquainted with the process.

OF SKIMMING.

It may be thought strange that no mention has been made of skimming the yeast off the gyle tuns, a practice now so prevalent. I have often tried it without finding any benefit; on the contrary, I found it only a waste of time, as well as a considerable waste of beer. I could only therefore come to the conclusion, that its original adoption must have arisen from being obliged to skim off the yeast in bad fermentations, to prevent its falling down through the beer, and thus making it *yeast-bitten*. This practice of skimming can do no good, but may do harm, from the length of the process exposing the beer to atmospheric action.

When any beer, either ale or porter has gone through a regular and good fermentation, and has then been cleansed at the proper time, it will throw off its yeast quite as well in the cleansing casks as by skimming, and may be all racked and drunk before the other is out of the gyle-tun, a great desideratum to small capitalists.

GENERAL SUMMARY.

To any one who has attentively perused the foregoing pages, it must appear self-evident, that want of success in brewing, generally proceeds from one or other of the following causes.

First, from want of attention to cleanliness.

Second, from not having good malt and hops to brew with.

Third, from using bad liquor or water.

Fourth, from being exposed to any undue electrical influence.

Fifth, from using bad yeast.

First, then, let us mention want of attention to cleanliness. The workmen when not very strictly looked after in cleaning the utensils, are very apt to slur that part of their work over, and in summer particularly, this may be attended with very injurious consequences. The casks in the trade, for sending out the beer, should also be most carefully attended to. Many are of opinion that if the casks do not smell

musty, they are all right when *blown* off with hot liquor. This, however, is not the case; the casks often, from bungs &c. being left out, get very sour, so much so that the acidity penetrates deeply into the pores of the wood, in which case, if means be not taken to sweeten them, the acidity will (particularly in hot weather) be very soon communicated to the beer. The principal cooper, therefore, in a large establishment has a very responsible situation. Where there is no regular cooper or storehouseman, this department should also be looked after by the brewer.

Second, not having good materials to brew with, viz., malt and hops. Many think that, by purchasing an inferior quality of malt at a low price, and allowing an additional quantity of such malt to a brewing, they not only save money, but that the beer will be equally good as that produced from better malt. It is very doubtful, however, whether they can even save money; the quality of the beer never can be so good, and they at the same time run the risk of unsoundness, ropiness, &c. There cannot, therefore, be the least doubt that the best malt will ultimately prove itself to be the better purchase.

Variety of opinions prevail with regard to hops. Rather too much importance, however, is

often attached to the different shades of colour or flavour. Perhaps for beer intended for immediate use, good Sussex or Worcester hops will be found to answer as well as any. For *keeping* beer, the strongest and best flavoured hops, wherever grown, should always be selected. Sometimes even good judges are puzzled to find out which are Kent, and which are Sussex, unless by the marks on the bags or pockets.

The third cause of want of success that I mentioned was bad water. Where the liquor is impregnated with any mineral, it is certainly very unfit for brewing. Where there is any putridity in the liquor, that should also if possible be avoided. But where neither of these occur, no bad consequences need be apprehended. It is for the interest of those who brew particularly fine flavoured ales, to attribute the flavour of these ales to something contained in the liquor used for brewing, in order perhaps to deter others, who cannot have the same sort of liquor, from trying to imitate them.

Sometime ago it was held to be quite impossible to brew porter, but with Thames water; now, however, very little porter is brewed with Thames water.

That locality, (proceeding, perhaps, more from an erroneous arrangement of the plant, than any thing else,) has often a great in-

fluence in brewing, cannot well be disputed, because even when the same materials of every description, including water, have been transferred from one place to another, and the same process followed in brewing, the same results have not been effected. In many other places besides Burton, water may be found running over the same salts as it does there. Why, therefore, cannot equally good ale be produced in those places? A different construction of the brew-houses may prevent it. The not using such good malt and hops may prevent it. Less specific gravity in the worts may prevent it; not having good fermentations may prevent it, want of attention to cleanliness may prevent it, there can be no other reasons. Ale of from 40 to 45lbs. gravity per barrel, will, if well brewed, always have a richer and better flavour than that of only 30lbs. per barrel, and the best Burton ales run from 40 to 45lbs. per barrel or more. The materials, therefore, and the strength give the fine flavour. The weaker Burton ales are certainly not one whit better than those brewed in other places. Let others, therefore, (attending to all the causes of prevention stated above) brew ale of equal strength, with pure water unimpregnated with any mineral or putridity, and they will find out the secret of brewing a beer, which, if not of precisely the same flavour

with Burton or any other particularly celebrated ale, will by the best judges be equally well liked.

It is a certain fact that ale has been brewed even in London, which has been preferred by good judges to any which could be had there, either from Burton or elsewhere. We cannot, therefore, suppose that the water either at Burton or Edinburgh has any connection with the flavour of their different beers, but must attribute any superiority in flavour they are said to possess, to other causes.

There is one thing which appears to be lost sight of, which is, that whilst brewers and others are continually speaking of the water with which they brew, as being preferable to other waters, they never seem to consider the nature of the soil on which the barley is grown. Now, as the wine from grapes on one soil is inferior to wine from grapes on another, so every farmer, from experience, will tell you that such and such a soil is not fit for barley, and there is no doubt that barley grown on such ineligible soils would make bad malt. In such cases, the water used in brewing is probably blamed, whilst the soil which afforded the barley escapes blameless.

The fact is, that water, as usually met with, contains the following impurities: *Carbonic acid gas*, to which the sparkling property of pump or

spring water is owing. *Carbonate of lime;* this salt is quite insoluble in water, but it is held in solution in water by excess of carbonic acid. When water is boiled, the carbonic acid in excess is expelled, and the carbonate of lime falls down, and thus it is, that the crust is formed in boilers. *Sulphate of lime;* this salt communicates the hard property, as it is called, to water, and it is always known to be present if the water curdle when soap is added to it. Besides these impurities, water generally contains muriate of soda (common salt) and other muriates. By the term *impurities,* we are not to infer any thing prejudicial in the water, that is, when drunk by itself: the term merely applies to any substances foreign to the real composition of water. Even rain water, which is water *naturally* distilled, contains impurities. Of mineral waters I shall say nothing, as no one would ever think of employing these in the process of brewing, unless from necessity.

Fourth, To unsoundness in the worts we have every reason to think, may be attributed the great prevailing cause of almost all the evils in the brewery. It is impossible, therefore, to carry our researches too far in trying to investigate the causes of this hitherto incurable evil. Inferior malt may produce unsound wort; want of cleanliness also. Too long standing of the

last liquors on the goods in the mash tun, will almost invariably produce unsoundness; or allowing the worts to lie too long in the underback or coolers. But though last, not least, an electrical or galvanic action. It has been already stated as an undisputed fact, that milk in a dairy, when not placed in an insulated situation, is immediately made sour by electricity. May it not have the same effect upon other fluids, such as worts, &c., when they are not insulated? I am supported not by my own practice alone, but by the best chemical authorities, in not only saying that it may, but that it actually has the same acidifying action on beer, and I maintain also on worts. As long, therefore, as any of our utensils are imbedded in the ground, or connected with the ground by means of iron or other metals, the same electrical action which sours milk, may to a certain extent sour worts or beer. How often have brewers, the most attentive to cleanliness and every thing else, been surprised to find their worts tainted without being able in any way to account for it. Probability, therefore, is at least in my favour, that electricity is the hidden cause, and when supported, not only by the facts already mentioned in this book, and others which might be adduced, but by such authorities as I have already mentioned, I think I

may presume to say, that when the point is thoroughly investigated by scientific men, electricity or galvanism will be found to be in the brewery a much more powerful enemy than we have at present any idea of. I trust, therefore, that what I have said may be the means of drawing the attention of those most interested, to a thorough investigation of a subject of so much importance, and hitherto so little attended to.

Fifth, Bad yeast, which is in the first place produced from unsound worts, will never pass through a thoroughly regular fermentation, and the beer of course can never be depended upon. It is, therefore, of the utmost importance, that before commencing to brew, the quality of the yeast we have to work with, should be minutely examined. It should not be altogether white, but rather of a fine rich cream colour; if very brown, we may rest assured that it is unfit for our purpose, and we must, therefore, endeavour to get better. There is also sometimes a sort of blue glassy appearance in yeast, which I cannot describe, but it indicates its having been produced from an inert or sluggish fermentation, and also, therefore, by no means to be depended upon. In short, experience alone can enable us to judge of the quality of yeast by its appearance.

Of this, however, we may be quite certain, that if we have not a regular fermentation going through its five different changes in the proper progression, there must be something wrong somewhere, and we must set all our wits to work, to find out where that something wrong lies. The fact is, there are two kinds of observers: one of these are contented in merely noticing a fact, which may escape the observation of hundreds; but here they stop: the other kind not only notice the fact, but they are unsatisfied until they can trace the cause.

APPENDIX.

DIASTASE.

THE researches of the French chemists last summer will shed a new light on the nature and properties of malt, and the mode of extracting. *Starch* is described as consisting of minute particles, like granules, each of them included in a skin or cuticle, a thick, slimy, gum-like body, and therefore resembling somewhat the structure of seeds. To the internal contents of these granules, M. Biot gave the name *dextrin;* it might also be called starch-gum, because in its properties it is quite analagous with the latter. The skinned integument, including the *dextrin,* prevents the starch from coming forth; for starch is not soluble in cold water. But by breaking the cuticle this is accomplished, and gum produced from starch, or rather gum contained in starch, is made free.

For attaining this, the following means are at present known. — 1, *Boiling*. The more such particles are torn by the heat, the more of the gum is dissolved; and the more particles of

starch are preserved in the fluid, the more paste-like remains the latter.—2, *Roasting*. In both cases, the heat partly tears and partly annihilates the cuticles. This case sometimes occurs in kiln-drying.—3, Treating it with some acid fluid.—4, Treating it with malt, which, in a manner not yet known, by a substance contained in it (*diastase*), has the power of lacerating the cuticles of the starch granules. The *diastase* contained in malt is said to be a solid, white, tasteless, uncrystallized body, soluble in water, but insoluble in alcohol. Dissolved in water, it turns sour very soon. Its most remarkable property is, that one part of it is sufficient to tear, or burst open, 2000 parts of potatoe starch diluted by 8000 parts of water, by which means its dextrin becomes free, and its insoluble cuticles are either precipitated or made to swim on the surface. Diastase is produced by diluting malt-meal, or bruised malt, in cold water, filtering the fluid, and heating it: it becomes turbid, and some substance resembling white of eggs is precipitated: strain again, and add absolute alcohol (free of water), whereby the diastase falls to the bottom, while the sugar which was in the malt remains dissolved. It is then dried by a low heat, because a higher one would decompose it. The heating of the solution is not necessary: or the diastase may be

separated by the mere action of alcohol. Diastase, produced in the above manner, is not quite pure, still containing some azotic substance, which may be removed by a repeated digestion of the product by water, and precipitation by alcohol. In seeds, which have undergone germination, it is contained in the immediate neighbourhood of the blade, but not in the rootlets. By the boiling-heat the diastase loses the power of converting starch into gum and sugar: this, therefore, is the substance by the action of which saccharification takes place in the mash-tun.

This completely accounts for an almost instantaneous change of colour in the extract, which invariably takes place in the mash-tun during the first mash, when the heats are properly taken.

If, therefore, this change of colour do not take place, we may rest assured that our mashing temperature is wrong.

It also proves what has been already stated in the foregoing pages, that nearly the whole of the extract is made in the first mash, and that all we do afterwards is merely washing out that which remains of the extract in the grains.

It also shows the importance of taking our

first mashing temperature properly. By the boiling temperature, say the French chemists, the *diastase* loses the power of converting starch into gum or sugar. Thus *setting the goods* in the tun.

It may be possible that a considerably lower temperature than the boiling may have the same effect of destroying the power of the *diastase;* indeed we know that it does so, as goods have often been set at much lower temperatures than boiling. As already stated, therefore, under the head of Brewing, we should rather turn on the first liquor too low than too high; for too low a temperature may be corrected in the after process, whilst, on the other hand, we now have it distinctly pointed out to us, that too high a temperature is destructive.

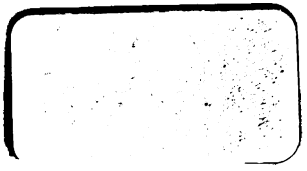
This discovery of the French chemists may also lead to other very important results in the formation of extracts; but as it has only been pointed out to me by a friend since writing the foregoing pages, we are neither of us altogether prepared to give the results of any practical observations we have as yet made upon the subject. I know, however, that my friend, already mentioned, Mr. Robert Stein, had, long ago, ideas as to the formation of extracts, which this new discovery appears completely to confirm.

I have heard that, in Bavaria, they have a mode of making malt in six days, which they dry in seven hours; and that the quality of the malt is, both in colour and flavour, quite as good as any made in England. The friend, however, who gave me this information is not as yet altogether in possession of their process: but most likely our present Excise laws would prevent its adoption, even were it proved to be beneficial.

OF TESTS FOR WATER.

To those who may wish to analyze their brewing liquor, I would beg to recommend a perusal of Maugham's Improved Chemical Reagents, or Tests, in which will be found the most simple modes of ascertaining whatever impurities may be contained in any water.

The London Manual of Medical Chemistry, by the same author, under the heads *Extracts, and Vegetable Chemistry,* will point out some bad effects which may arise from too long boiling of worts.

THE END.

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